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ABSTRACT

The guide, designed for sixth, seventh, or eighth grade teachers and students, presents five mathematics instructional units for career exploration related to the occupational clusters transportation, communication, manufacturing, health, and business and office occupations. The units deal specifically with: shippers of household goods, the computer, metric measure, and hospital workers. Each unit is based on behavioral objectives which are stated as terminal objectives, dealing with the subject matter to be covered, and as specific objectives, dealing with the student performance necessary to reach the terminal objective. The other components of each unit are:list of suggested activities for instructor and student, reference list, information sheets outlining the content of the unit and a brief description of jobs related to the unit, assignment sheets pro specific written activities, job sheets providing creative projects, answers to assignment sheets, a unit test, and answers to the test. Some units also contain transparency masters. Instructions for using the guide and forms and guidelines for field trips, interviews, and resource people are included. (MS)

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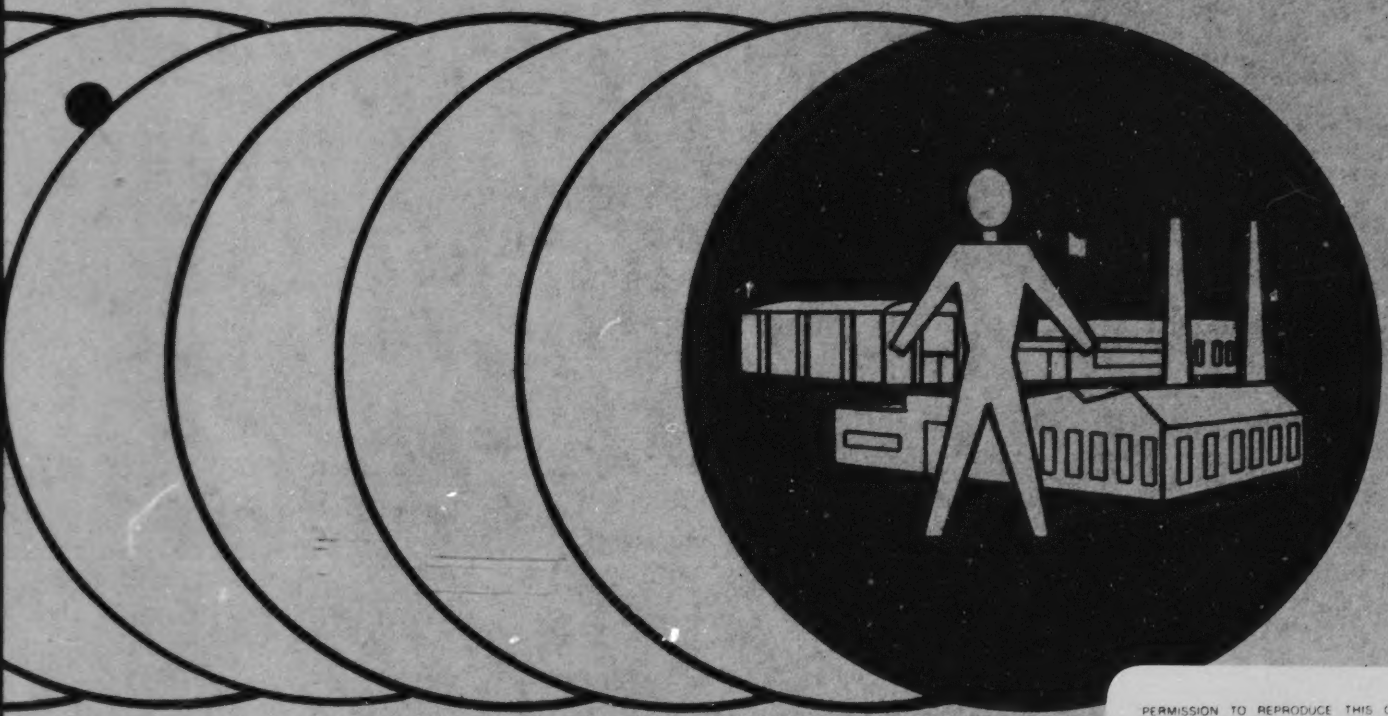
Career Education

Math



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STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION/STILLWATER, OKLAHOMA

CAREER EDUCATION MATH

UNITS FOR CAREER EXPLORATION IN SIXTH, SEVENTH OR EIGHTH GRADE

Development and Revision
Coordinated by:
Mary Robinson, Curriculum Specialist
State Department of Vocational-Technical Education
Stillwater, Oklahoma
1974

OKLAHOMA STATE BOARD OF VOCATIONAL AND TECHNICAL EDUCATION
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(NOTE: These units need not be taught in any specific order.)

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INTRODUCTION

In the school-based model of career education, students should be ready for the career exploration stage at approximately grades seven and eight. Career exploration should be part of the daily curriculum infused into the major subject areas to help students become aware of occupations that lead from the subject areas.

One of the key concepts of career education is for every teacher in every course to emphasize the contribution that subject matter can make to a successful career. This publication is designed to help the classroom teacher achieve this concept.

In the exploration phase of career education students are exposed to basic concepts needed for success in the occupational cluster. Exposure to basic concepts is accomplished through hands-on activities, field trips, work observations, role playing, and simulations. This approach helps the students to understand themselves in relation to the educational and occupational alternatives, including the occupational outlook available to them.

These units are not intended to replace present subject matter content but rather to enhance the learning of subject matter skills. It is our belief that student motivation can be increased by making curriculum more relevant to his lifetime career needs.

Field Testing

An intensive two day workshop was held in July, 1973, at Central State University in Edmond, Oklahoma, for teachers committed to field test these units during the 1973-74 school year. During the workshop teachers were oriented to the concepts of career education and to the format for these materials. The teachers also received training for teaching a unit of instruction.

The materials were field tested by selected teachers from the following schools during the 1973-74 school year: Central Junior High School, Bartlesville; Orlando Junior-Senior High School; Blackwell Junior High School; Lindsay Junior-Senior High School; Jefferson, Rogers, and Eisenhower Middle Schools, Oklahoma City; and Irving, Longfellow, and Whittier Middle Schools, Norman. The career education curriculum staff worked closely with the teachers during field testing. Evaluations were collected and revisions were made as recommended.

Field Trips and Resource Personnel

It is suggested that both field trips and guest speakers be utilized as much as possible for the geographic area. These activities allow students to relate to people who work at various jobs and to see people in their work environments. Emphasis for both field trips and guest speakers should be on the worker rather than on the product. For example, on a field trip to a factory attention should be directed toward the workers there, what they do, how they receive their training, how one worker depends on many others, and what they like or dislike about their jobs.

The teacher is responsible for guiding the choice of field trips and guest speakers and for selecting the time at which the students will profit most from the experience. To become familiar with the place to be visited and the things to be seen, the teacher should, if possible, investigate the field trip site by taking the trip in advance. Permission for a trip must be obtained from the school principal, the person in charge of the place to be visited, and the parents of the students.

Students can be taught some general interviewing techniques which can be used for interviewing workers on a job or resource persons brought into the classroom. Precautions should be taken to see that students do not disturb the workers too much. Specific students could be assigned to interview certain kinds of workers and then report to the entire class. Plans for interviewing should be cleared with the business prior to the visit. It may be advisable to provide the resource site or resource speaker with a list of questions the students are likely to ask.

Some sample forms and questions are provided on the following pages. These can help the teacher prepare for more effective utilization of field trips and resource personnel.

BUSINESS SURVEY SHEET

1. What is the name of your business?____________________

   A. Address____________________

   B. Phone____________________

2. Who should be contacted to arrange a visit to your business?

   ____

   A. Position with firm____________________

   B. Phone____________________

3. Would someone be able to visit the classroom to prepare for the trip or follow it up?____________________

4. For what age children is the tour appropriate?____________________

5. How many can be accommodated at one time?____________________

6. How many school groups can be handled per year?____________________

7. What is the best time of year to visit?____________________

8. What is the best time of week to visit?____________________

9. What is the best time of day to visit?____________________

10. How much time is needed for the visit?____________________

    What is the cost to the pupils?____________________

    To the school?____________________

11. Are there facilities for meals?____________________

    Is there ample parking space?____________________

    A. Bus____________________

    B. Car____________________

12. Do you have special exhibits, film, tapes, etc. that could be used for instructional purposes? If so, what are the subjects and how may they be secured?

    ____

    ____

Questionnaire (continued)

13. Brief description of the tour______________________________

14. Is guide service provided?______________________________

15. Are there any special safety precautions to be observed during the visit?______________________________

16. In what other ways can the business and industries of this area contribute to the education of our young?______________________________

17. What can the school community do for you?______________________________

x

PERMISSION SLIP FOR FIELD TRIPS

(to parent or guardian)

School ______________________
Teacher _____________________
Grade _______________________

___________________________ has my permission to participate in career
(Student's Name)
exploration field trips with the Industrial Arts classes for the __________ school year.

Signed,

____
(Date)

____
(Parent or Guardian)

FIELD TRIP REQUEST
(to authorized school personnel)

DATE:________________________

SCHOOL:____________________TEACHER________________ROOM___

Business or Industry to be visited:

____

____ Phone: ___________

Special Areas of Interest:

____

____

____

Date(s) requested_____________Date(s) confirmed_____________

Grade Level________Age________Size of Group____No. of Adults____

Type of Transportation needed (bus or walk)_________

Leave (time)____________________Return (time)_________________

APPROVED: ___________________________ Counselor

___________________________ Building Principal

___________________________ Office of Superintendent

DISAPPROVED: __________________________

REASON: ____

____

____

RESOURCE SITE OBSERVATIONS

(NOTE: Distribute to students prior to field trip. These guidelines may also be used for personal interviews.)

1. The number of different jobs in existence at the resource site.
2. The number of people employed in each job.
3. Nature of the work done.
4. Whether a particular job is expanding or declining.
5. Educational and training requirements.
6. The route to getting a particular job.
7. Age requirements to work in different areas.
8. Physical requirements.
9. Hours per week employees are required to work.
10. Opportunities for advancement.
11. Whether union or other membership is required.
12. Vacation time allotted.
13. Whether or not there are health insurance and retirement or pension plans.

PREPARATION FOR INTERVIEWS

The following is a list of helpful hints for teachers and pupils when preparing for interviews:

1. Teachers should be aware and make students aware that misinformation may result from an interview. The worker may misunderstand the questions, or he may not have the detailed information that the student is seeking.
2. It may be helpful to send the resource person a list of questions the class is considering.
3. Familiarize pupils with questions and have them mark the questions they would like to ask.
4. Inform pupils before an interview that the resource person does not have to answer a question if he does not want to.
5. Teachers should be alert to step in and help facilitate communication if either the student or resource person is not understanding what the other has said.
6. The teacher should feel free to clarify questions and answers whenever it is desirable to do so.
7. Pupils should be given the opportunity to discuss the reason why a worker may oversell or undersell his field, such as a need to impress his listeners, a lack of information due to limited experiences in the field, or a need to rationalize his own success or failure on the job.

QUESTIONS FOR RESOURCE PEOPLE

(NOTE: These questions could be utilized by students when interviewing a resource person.)

1. What do you do on the job?
   a. What time did you go to work this morning?
   b. What was the first thing you did?
   c. How long did that take (cover the entire day)?
   d. Did you do anything yesterday that was different from today?
2. Why did you take this job?
3. Was this your first job choice?
4. How many times did you change your mind about what you wanted to be before you went to work?
5. What part of your job do you like best? Is there a part of your job you do not like? Are there any hazards?
6. Who depends upon your work?
7. What experiences and training on this job might prepare you for some other kind of job should you ever want to change?
8. Do you work nights and days?
9. Are you tired when you get home? On your job do you have to be nice to people who are crabby and ill-mannered?
10. What inventions could put you out of work?
11. Are people with your kind of skills usually needed even when business may be bad? Is your work at all seasonal? Is this type of work limited to geographical areas?
12. What type of education is necessary for this work?
13. What classes did you have in the sixth grade that help you now in your work?
14. Is there any personal quality required for this job?
15. In general, what are the starting salaries in this type of work?
16. When does your boss compliment you or when do you compliment your employees?
17. When are people fired?
18. What school did you attend?

19. What changes have taken place recently?

20. Do you expect any changes in the near future?

21. What qualifications do you need to get your job, such as

    a. Age
    b. Height
    c. Weight
    d. Sex
    e. Marital status
    f. Veteran
    g. Union
    h. License

22. Is it permissible to get another employee to cover your job if you want time off?

23. Did any of your leisure activities increase your ability to obtain this job or help you to perform better on this job?

24. Did you have to make a decision between two or more jobs?

25. Is there anything we need to know about the job that has not been asked?

USE OF THIS PUBLICATION

Instructional Units

The Math curriculum includes five instructional units. Each instructional unit includes behavioral objectives, suggested activities for teacher and students, information sheets, assignment sheets, visual aids, tests, and answers to the test. Most units are planned for approximately ten hours of instruction.

Careful study of each instructional unit by the teacher will help him determine:

A. The amount of material that can be covered in each class period
B. The skills which must be demonstrated
    1. Supplies needed
    2. Equipment needed
    3. Amount of practice needed
    4. Amount of class time needed for demonstrations
C. Supplementary materials, such as pamphlets and filmstrips, that must be ordered
D. Resource people that must be contacted

Objectives

Each unit of instruction is based on behavioral objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student.

Behavioral objectives are stated in two forms: Terminal Objectives stating the subject matter to be covered in a unit of instruction and Specific Objectives stating the student performance necessary to reach the terminal objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which were used in this material:

Name
Label
List in writing
List orally
Letter
Record
Repeat
Give

Identify
Select
Mark
Point out
Pick out
Choose
Locate

Describe
Define
Discuss in writing
Discuss orally
Interpret
Tell how
Tell what
Explain

Order
Arrange
Sequence
List in order
Classify
Divide
Isolate
Sort

Distinguish
Discriminate

Construct
Draw
Make
Build
Design
Formulate
Reproduce
Transcribe
Reduce
Increase
Figure

Demonstrate
Show your work
Show procedure
Perform an experiment
Perform the steps
Operate
Remove
Replace
Turn off/on
(Dis) assemble
(Dis) connect

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the material to the needs of the students and community. When a teacher adds objectives, he should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a Suggested Activities sheet outlining steps to follow in accomplishing specific objectives. The activities are listed according to whether they are the responsibility of the instructor or the student.

Instructor: Duties of the instructor will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheets, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss terminal and specific objectives and information sheets; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Students: Student activities are listed which will help the student to achieve the objectives for the unit.

Information Sheets

Information sheets provide content essential for meeting the cognitive (knowledge) objectives of the unit. The teacher will find that information sheets serve as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the terminal objective.

Students should read the information sheets before the information is discussed in class. Students may take additional notes on the information sheets.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective for such activities as learning and locating the parts of a machine.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the teacher spot difficulties being encountered by students in their efforts to accomplish the terminal objective. Test items for objectives added by the teacher should be constructed and added to the test. Progress sheets are provided for student and teacher to record acceptable performance of skills outlined in job sheets.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to compute the cost of packing, crating, shipping, and delivering goods. He should be able to name three jobs in the moving business that would use primary math skills. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms and definitions associated with the moving business.
2. List three reasons for keeping accurate records.
3. Name three jobs in the moving business that would use primary math skills.
4. Discuss steps in determining the cost for packing goods.
5. Demonstrate the ability to compute:
    a. Total packing cost.
    b. Total crating cost.
    c. Total transportation cost.
    d. Total delivery cost.
    e. Total cost of shipping goods.

This unit was written by Tom Christman and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide students with objective sheet.

  B. Provide students with information sheet.

  C. Discuss terminal and specific objectives.

  D. Discuss information and assignment sheets.

  E. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet.

  C. Complete assignment sheets and turn in to instructor.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

  A. Objectives

  B. Information sheet

  C. Transparency masters

    1. TM 1--Rates and Charges

    2. TM 2--Labor Charges for Crating

    3. TM 3--Table of Measurements

    4. TM 4--Rates for Crating

    5. TM 5--Transportation Rates

D. Assignment sheets

1. Assignment Sheet #1--Charges for Packing Goods
2. Assignment Sheet #2--Compute the Cost for Crating Goods
3. Assignment Sheet #3--Compute the Total Cubic Feet for Shipping
4. Assignment Sheet #4--Compute Transportation Costs
5. Assignment Sheet #5--Compute the Cost of Shipping Goods
6. Alternate Assignment Sheet--Compute the Total Cost of Shipping Goods

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

A. Estimate sheet of any moving and storage company.

B. *Mover's and Warehousemen's Association of America, Inc., Agent, Tariff No. 56.* Naming local, joint, distance and commodity rates on household goods between points within the United States.

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MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

INFORMATION SHEET

I. Terms and definitions

   A. Comparison sheet--Used by movers to determine the number of cubic feet of space an item takes up

   B. Rate book--Contains prices for containers, barrels, rates for packing and crating, rates for any special service, and the transportation rate

   C. CWT--Per hundred weight

   D. Barrel--Used to pack and ship china and other breakable items

   E. Shipping--Moving goods from one place to another place

   F. Shipping space--The space goods take up when moving them

   G. Wardrobe carton--Cartons used to pack and ship clothes

   H. Cartons--Used to pack small items such as books, lamps

   I. Boxes--Used to crate and ship such items as end tables, coffee tables, night tables

   J. Transportation rate--The amount charged for shipping from the point where the load is picked up to the point of destination

   K. Delivery charge--Charge for any stop(s) made in excess of the initial pickup and delivery at final destination

II. Reasons for keeping accurate records

   A. Reduces the possibility of errors

   B. Ensures proper income tax records

   C. Checks gains or losses of the company

III. Jobs which use primary math skills

   A. Moving estimator

   B. Storage estimator

   C. Cargo agent

   D. Operations manager

INFORMATION SHEET

IV. Steps in determining the cost for packing goods (Assignment Sheet #1)

- A. View items to be packed
- B. Estimate the kind and number of cartons and barrels to be used
- C. Determine the total packing charges for items to be packed
  - 1. Find the rate charges for cartons and barrels (Transparency 1)
  - 2. Multiply the number of each kind of carton or barrel times the rate charge for that container
  - 3. Add all products together
- D. Determine the labor charge for packing the cartons
  - 1. Locate the charge per carton or barrel (Transparency 2)
  - 2. Multiply the labor charge for each type carton or barrel times the number of cartons and barrels
  - 3. Add the total charges together

  (NOTE: Articles which might be damaged during transportation should be packed in cartons or boxes provided for this purpose.)
- E. Determine the total packing cost by adding the charges for cartons, barrels, and labor (Total of items C and D above)

V. Procedure for computing the cost for crating goods (Assignment Sheets #2 and #3)

- A. Find the cubic feet measurement of each item on a table of measurement (Transparency 3)
- B. Find the total cubic feet of all items
- C. Find the charge per cubic foot (Transparency 4)
- D. Multiply the total cubic feet by the charge per cubic foot

  (NOTE: Articles which might be damaged during transportation but are too large to pack should be crated for their protection.)

VI. How to compute the cost for transportation of goods (Assignment Sheet #4)

- A. Determine estimated weight of items to be shipped
  - 1. Find the cubic feet measurement of each item to be moved
  - 2. Find the total cubic feet measurement of all items

INFORMATION SHEET

3. Multiply the total cubic feet measurement times seven pounds per cubic foot

B. Determine total distance to be traveled

C. Find transportation rate (Transparency 5)

VII. Rules for determining the delivery charge (Assignment Sheet #5)

A. Initial pickup and final delivery charges are included in the transportation rate

B. There is a charge of $20 per stop for all stops other than initial pickup and final delivery

(NOTE: This charge is subject to change.)

Rates and Charges

Taken from Tariff No. 56 Booklet--Section I pages 34-35.

SERVICE	PER	RATES	
		SCH. A	SCH. B
Barrels:	each	$8.50	$9.25
Cartons:			
Less than 1 1/2 cu. ft.	each	1.00	1.25
1 1/2 cu. ft.	each	2.25	2.50
3 cu. ft.	each	3.25	3.50
4 1/2 cu. ft.	each	3.75	4.00
6 cu. ft.	each	4.25	4.50
6 1/2 to 10 cu. ft.	each	4.75	5.25
Wardrobe Cartons:	each	5.00	5.50
Mattress Cartons:	each	3.50	3.75
Crib Mattress Cartons:	each	2.00	2.25

Labor Charges for Crating

Barrels	Each	$2.00
Cartons (Not over 10 cu. ft.)	Each	.75
Wardrobe Carton	Each	5.00
Mattress Carton, Crib	Each	1.00
Mattress Carton (Not exceeding 54" x 75")	Each	1.90
Mattress Carton (Exceeding 54" x 75")	Each	3.25
Mirror Carton	Each	3.50

Table of Measurements

ARTICLE	Cu. Ft. PER PIECE
LIVING ROOM	
Chair, Arm	10
Clock, Grandfather	20
Davenport, 2 cushions	35
Television Combination	25
Tables, Coffee	5
DINING ROOM	
Chair	5
China Closet	25
Table, Extension	30
Buffet	30
BEDROOM	
Bed:	
Double	60
Single	40
King Size	70
Double Dresser	50
Night Table	5
APPLIANCES (Larger)	
Dryer	25
Range	30
Refrigerator:	
6 cu. ft. or less	30
7 to 10 cu. ft.	45
11 cu. ft. or more	60

Rates for Crating

Taken from Tariff No. 56 Booklet-Section I, pages 34-35

SERVICE	PER	RATES	
		SCH. A	SCH. B
Boxes, Wooden:			
Not over 5 cu. ft.	each	$4.50	$5.00
Over 5, not over 8 cu. ft.	each	8.00	8.75
Over 8 cu. ft.	cu. ft.	$1.50	$1.75

Transportation Rates

Taken from Tariff No. 56 Booklet - Section IX, pages 94-95.

MILES	500 lbs to 999 lbs	BREAK POINT	1000 lbs to 1999 lbs	BREAK POINT	2000 lbs to 3999 lbs	BREAK POINT	4000 lbs to 7999 lbs	BREAK POINT	8000 lbs to 11,999 lbs	BREAK POINT	12000 lbs and over
1-15	$5.79	676	$3.91	1,678	$3.28	3,561	$2.92	6,439	$2.35	11,439	$2.24
16-20	6.05	673	4.07	1,666	3.39	3,505	2.97	6,465	2.40	11 451	2.29
161-170	10.22	664	6.78	1,570	5.32	3,256	4.33	6,929	3.75	11,681	3.65
191-200	10.89	666	7.25	1,567	5.68	3,233	4.59	7,181	4.12	11,389	3.91
926-950	18.14	696	12.61	1,753	11.05	3,396	9.38	7,736	9.07	11,590	8.76
1001-1050	18.61	709	13.19	1,762	11.62	3,446	10.01	7 705	9.64	11,615	9.33
1051-1100	18.92	714	13.50	1,769	11.94	3,458	10.32	7,721	9.96	11,687	9.70
3351-3400	27.99	822	22.99	1,846	21.21	3,727	17.76	7,851	19.39	11,871	19.18
3701-3800	28.51	827	23.56	1,859	21.89	3,725	20.38	7,898	20.12	11,845	19.86

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ASSIGNMENT SHEET #1--CHARGES FOR PACKING GOODS

Estimate the total packing charges for the following items, using both Schedules A and B (Transparencies 1 and 2).

4	Barrels
3	(3 cubic foot) cartons
1	(4 1/2 cubic foot) carton
2	(10 cubic foot) cartons
3	Wardrobe cartons
2	Mattress cartons (54" x 75")
1	Crib mattress

1. Schedule A
   - a. Total rate ______
   - b. Total labor ______
   - c. Total packing charge ______
2. Schedule B
   - a. Total rate ______
   - b. Total labor ______
   - c. Total packing charge ______

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ASSIGNMENT SHEET #2--COMPUTE THE COST FOR CRATING GOODS

Compute the total cost for crating the following items. Use Schedules A and B (Transparencies 3 and 4).

	ITEM	COST Schedule A	 Schedule B
1.	Buffet		
2.	Double dresser		
3.	2 night tables		
4.	Coffee table		
5.	TOTAL CRATING CHARGES		

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ASSIGNMENT SHEET #3--COMPUTE THE TOTAL CUBIC FEET FOR SHIPPING

1. Using the table of measurement find the total cubic feet of space for the items listed.

	ITEM	CUBIC FEET
a.	Davenport, 2 cushions	________
b.	Tea cart	________
c.	Night table	________
d.	Freezer (12 cu. ft.)	________
e.	Cedar chest	________
f.	Small desk	________
g.	Breakfast table	________
h.	Work bench	________
i.	Washing machine	________
j.	Range	________
k.	Dryer	________
l.	China closet	________
m.	King size bed	________
n.	Television combination	________
o.	Refrigerator (14 cu. ft.)	________
p.	Arm chair	________
q.	Ironing board	________
r.	TOTAL CUBIC FEET	________________

ASSIGNMENT SHEET #3

2. Using the table of measurement and the given number of pieces, compute the total number of cubic feet of furniture.

TABLE OF MEASUREMENTS

Date ____________

LIVING ROOM

	No. of pieces	Cu. ft.
Bookcase	20	1
Bookshelves, Sectional	5	3
Chair, Arm	10	2
Chair, Overstuffed	25	1
Chair, Rocker	12	1
Divan, 3 cushions, hideabed, or studio couch	50	2
Desk, small or winthrop	22	1
Desk, Secretary	35	1
Lamp, Floor	3	2
Music Cabinet	10	1
Tables, Coffee	5	3
Television, Combination	25	1
Television or Radio Console	15	1

DINING ROOM

Chair	5	6
China Closet	25	1
Table, Extension	30	1

BEDROOM

Bed, incl. spring & mattress: double	60	2
Bureau, Dresser, Chest of Drawers	25	2

APPLIANCES (LARGE)

	No. of pieces	Cu. ft.
Air Conditioner, Window	30	2
Dryer, Elec. or Gas	25	1
Freezer: (Cu. Capacity) 16 and over	60	1
Range, Elec. or Gas	30	1
Refrigerator: (Cu. Capacity) 11 cu. ft. and over	60	1
Washing Machine	25	1

PORCH, OUTDOOR FURNITURE, AND EQUIPMENT

Garden Hose and Tools	10	1
Lawn Chairs	5	2
Power Mower	15	1
Portable Grill or Barbecue	10	1

MISCELLANEOUS

Ash or Trash can	7	1
Card Table	1	2
Cabinet, Filing	20	5
Clothes Hamper	5	1
Fan	5	1
Fernery or Planter Stands	10	1
Golf Bag	2	2
Tool Chest	10	1
Vacuum Cleaner	5	1

ASSIGNMENT SHEET #3

BEDROOM (Con't)

Dresser, Double (Mr. & Mrs.)	50	2
Night Table	5	2

KITCHEN

Ironing Board	2	1
Stool	3	1

Total Column 1

CONTAINERS

Barrels	10	2
Boxes, Wooden	3	4
Boxes, Wooden	5	3
Boxes, Wooden	10	1
Cartons	3	7
Cartons	5	3
Cartons	10	10
Crates	5	2
Crates	20	3
Wardrobe furnished by Carrier	15	4

Total Column 2

Total Column 1 ____________

Total Column 2 ____________

Total Cu. Ft. ____________

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ASSIGNMENT SHEET #4--COMPUTE TRANSPORTATION COSTS

The first column in the rate table (Transparency 5) shows the number of miles to be traveled. The other columns have groups of weights. To determine the rate for the total weight of goods to be shipped you first locate the total weight in the weight column. For example, if you had a total weight of 600 pounds, you would use the column headed 500 lbs. - 999 lbs. Next you would look under the mileage column and find the number of miles the goods are to be shipped. If the goods are to be shipped 200 miles, you would go down the mileage column to 200 miles and across from that point to 600 pounds. You will find that the charge for 600 pounds being shipped 200 miles is $10.89. This charge is per hundred weight (CWT). There are 6 CWTs in 600 pounds; therefore, you would multiply 6 x 10.89 to determine transportation charge for this load of goods, which would be $65.34.

You will notice that there is a column entitled break point. This means if your weight happens to be more than this number, then you will have to move to the next column to the right to find the transportation charge for your load.

Example: Total estimated weight of shipment is 7100 pounds and it is to be shipped from Oklahoma City to Fort Smith, Arkansas, a distance of 200 miles.

Use Transparency 5 and find the mileage in the first column. The distance of 200 miles falls in the 191-200 miles bracket.

The weight of 7100 pounds falls in the 4000 to 7999 lbs. column. The charge for CWT is $4.59.

Check the break point column to make sure this rate is applicable to 7100 pounds. The break point is 7,181 lbs., and since 7100 lbs. is less than the break point the rate of $4.59 CWT should be used.

Multiply the number of CWTs (71) times the CWT charge ($4.59) to determine the total transportation charge ($325.89).

Use Transparency 5 to solve these problems:

	Mileage	Weight	Costs
1.	12	1500 lbs.	________
2.	1020	4000 lbs.	________
3.	1100	1800 lbs.	________
4.	165	8000 lbs.	________
5.	3775	3333 lbs.	________

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ASSIGNMENT SHEET #5--COMPUTE THE COST OF SHIPPING GOODS

You are to compute the total cost of shipping a houseful of furniture and personal belongings from Wichita, Kansas to Phoenix, Arizona, a total distance of 1,026 miles. You will be computing this cost on the following items. Two extra stops, other than initial pickup and final delivery, will be made.

2 Double beds, including springs and mattresses
2 Chest of drawers
1 Double dresser
4 Night tables
1 China closet
6 Dining chairs
1 Table, extension
1 Tea cart
1 Arm chair
1 Rocker chair
1 Overstuffed chair
1 Davenport, hideabed
1 Floor lamp
1 Large rug
1 Bathinette
1 High chair
1 Baby crib
1 Play pen
1 Toy chest
1 Dryer
1 Range
1 Washing machine
1 Refrigerator, 13 cubic feet
1 Window air conditioner
1 Card table
1 Day bed
1 Fan
1 Small desk
1 Kitchen cabinet
1 Television combination

All items in the above list, except the four night tables, are to be packed. The size and number of containers needed to pack these items are listed below.

Container(s)	Rate	Labor
3 Barrels		
3 Cartons (3 cu. ft.)		
8 Cartons (6 1/2 cu. ft.)		
5 Wardrobes		
2 Mattresses (54" x 75")		

1. Use the packing rates in Schedule A (Transparency 1) to determine the packing charge for each container(s). Add all packing charges together to find the TOTAL PACKING CHARGE ___________

2. Use the labor rates (Transparency 2) to determine the labor charge for container(s). Add all labor charges together to find the TOTAL LABOR CHARGE. ___________

ASSIGNMENT SHEET #5

3. Add the TOTAL PACKING CHARGE to the TOTAL LABOR CHARGE to determine the TOTAL PACKING COST. __________

The four night tables are to be crated before shipping

4. Determine the cubic foot measurement of these night stands by using the attached table of measurement. __________

5. Find the crating charge in Schedule A. (Transparency 4) __________

6. Determine TOTAL CRATING CHARGE by multiplying the crating charge four times the total cubic foot measurement of the night stands. TOTAL CRATING CHARGE. __________

Figure the transportation charges on all items to be shipped. (Transparency 5)

7. Find the total weight of all items by completing the attached table of measurement. TOTAL WEIGHT __________

8. Determine the number of CWTs from the total weight by dividing 100 into the total weight. CWT. __________ (Round to the nearest whole number)

9. Find the charge per CWT for the total weight being shipped 1026 miles. (Transparency 5) CHARGE PER CWT. __________

10. Multiply the charge for CWT (Item 9) times the number of CWTs (Item 8) to determine the TOTAL TRANSPORTATION COST. __________

11. Determine delivery cost by multiplying the number of extra stops (2) times the charge per additional stop ($20.00). TOTAL DELIVERY COST __________

12. Determine the TOTAL COST OF SHIPPING THE GOODS by adding the following costs together.

    a. TOTAL PACKING COST (#3) __________

    b. TOTAL CRATING COST (#6) __________

    c. TOTAL TRANSPORTATION COST (#10) __________

    d. TOTAL DELIVERY COST (#11) __________

    e. TOTAL COST OF SHIPPING __________

ASSIGNMENT SHEET #5

TABLE OF MEASUREMENTS Date __________

LIVING ROOM

	No. of pieces	Cu. ft.
Bookcase	20	
Chair, Arm	10	
Chair, Overstuffed	25	
Chair, Rocker	12	
Clock, Grandfather	20	
Davenport, 2 cushions	35	
Davenport, 3 cushions, hideabed, or studio couch	50	
Day Bed	30	
Desk, Small or Winthrop	22	
Lamp, Floor	3	
Rugs, Large, Roll, or pad	10	
Tables, Coffee, End, or Nest	5	
Television Combination	25	
Television or Radio Console	15	

DINING ROOM

Buffet	30	
Chair	5	
China Cabinet	25	
Table, Extension	30	
Tea Cart	10	

BEDROOM

Bed, incl. spring & mattress: double	60	
Bunk (set of two)	70	

KITCHEN

	No. of pieces	Cu. ft.
Breakfast Table	10	
Ironing Board	2	
Stool	3	
Table	5	
Utility Cabinet	10	

APPLIANCES (LARGE)

Air Conditioner, window	30	
Dishwasher	20	
Dryer, Elec. or Gas	25	
Range, Elec. or Gas	30	
Refrigerator: (Cu. Cap.)		
7 to 10 cu. ft.	45	
11 cu. ft. and over	60	
Washing Machine	25	

MISCELLANEOUS

Bicycle	10	
Card Table	1	
Clothes Hamper	5	
Fan	5	
Golf Bag	2	
Tool Chest	10	

CONTAINERS

Barrels	10	
Boxes, Wooden	3	
Boxes, Wooden	5	
Boxes, Wooden	10	
Boxes, Wooden	15	
Boxes, Wooden	20	
Cartons	3	
Cartons	5	
Cartons	10	
Crates	5	

ASSIGNMENT SHEET #5

BEDROOM (Con't)

Bureau, Dresser, Chest of Drawers, Chifrb	25
Chaise Lounge	25
Dresser, Double	50
Night Table	5
Wardrobe, Large	40

NURSERY

Bathinette	5
Chair, High	5
Chest, Toy	5
Crib, Baby	10
Pen, Play	10

Total Column 1

CONTAINERS (Con't)

Crates	10
Crates	15
Crates	20
Crates	25
Wardrobe furnished by Carrier	15

Total Column 2

To arrive at the Estimated Weight of the shipment, use a Weight Factor of seven pounds per cubic foot for the total cubic foot measurement derived.

Total cubic footage __________ @ 7 lbs./cu. ft. = __________ Estimated Weight

Remarks and/or Figures:

The shipper hereby declares valuation in excess of the limit set forth on the following specific articles:

ARTICLE

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ALTERNATE ASSIGNMENT SHEET--COMPUTE THE TOTAL COST OF SHIPPING GOODS

Compute the total cost of shipping the furniture and personal belongings in your room from your town or city to a place of your choice. Use map mileage to figure the distance; then figure according to problems 1 through 12 on Assignment Sheet #5. Use the Table of Measurements on the next page to determine total cubic footage of items to be packed.

ALTERNATE ASSIGNMENT SHEET

TABLE OF MEASUREMENTS

Date ____________

ARTICLE	Cu. Ft. Per Pc.	No. of Pieces	Cu. Ft.
LIVING ROOM			
Bench, Fireside or Piano	5		
Bookcase	20		
Bookshelves, Sectional	5		
Chair, Arm	10		
Chair, Occasional	15		
Chair, Overstuffed	25		
Chair, Rocker	12		
Chair, Straight	5		
Clock, Grandfather	20		
Davenport, 2 cushion	35		
Davenport, 3 cushions, hideabed or studio couch	50		
Day Bed	30		
Desk, Small or Winthrop	22		
Desk, Secretary	35		
Fireplace Equipment	5		
Foot Stool	2		
Lamp, Floor	3		
Magazine Rack	2		
Music Cabinet	10		
Piano, Baby Grand or Upright	70		
Parlor Grand	80		
Spinet	60		
Radio, Table Model or Phono.	2		
Rugs, Large Roll or Pad	10		
Rugs, Small Roll or Pad	3		
Tables, Coffee, End or Nest	5		
Tables, Dropleaf or Occasional	12		
Tables, Library	20		
Telephone Stand and Chair	5		
Television Combination	25		
Television or Radio Console	15		
Television Table Model	10		
DINING ROOM			
Bar, Portable	15		
Buffet	30		
Cabinet, Corner	20		
Chair	5		
China Closet	25		
Server	15		
Table, Extension	30		
Tea Cart	10		
Rugs, Large or Pad	10		
Rugs, Small or Pad	3		
BEDROOM			
Bed, incl. spring 7 mattress:			
Double	60		
Single or Hollywood	40		
Bunk (set of 2)	70		
King Size	70		
Bureau, Dresser, Chest of Drwrs, Chifrb, or Chiffnr.	25		
Cedar Chest	15		
Chair, Boudoir	10		
Chair, Straight or Rocker	5		
Chaise Lounge	25		
Dresser or Vanity Bench	3		
Dresser, Double (Mr. & Mrs.)	50		
Night Table	5		
Rug, Large or Pad	10		
Rugs, Small or Pad	3		
Vanity Dresser	20		
Wardrobe, Small	20		
Wardrobe, Large	40		

ARTICLE	Cu. Ft. Per Pc.	No. of Pieces	Cu. Ft.
NURSERY			
Bathinette	5		
Bed, Youth	30		
Chair, Child's	3		
Chair, High	5		
Chest	12		
Chest, Toy	5		
Crib, Baby	10		
Table, Child's	5		
Pen, Play	10		
Rug, Large or Pad	10		
Rug, Small or Pad	3		
KITCHEN			
Breakfast Suite Chairs	5		
Breakfast Table	10		
Ironing Board	2		
Kitchen Cabinet	30		
Roaster	5		
Stool	3		
Table	5		
Utility Cabinet	10		
Vegetable Bin	3		
APPLIANCES (LARGE)			
Air Conditioner, Window	30		
Dehumidifier	10		
Dishwasher	20		
Dryer, Elec. or Gas	25		
Freezer: (Cu. Capacity)			
10 or less	30		
11 to 15	45		
16 and over	60		
Mangle	12		
Range, Elec. or Gas	30		
Refrigerator: (Cu. Capacity)			
6 cu. ft. or less	30		
7 to 10 cu. ft.	45		
11 cu. ft. and over	60		
Washing Machine	25		
PORCH, OUTDOOR FURNITURE AND EQUIPMENT			
Bath, Bird	5		
Garden Hose and Tools	10		
Glider	20		
Ladder, Extension	10		
Lawn Chairs	5		
Lawn, Mower (hand)	5		
Power, Mower	15		
Umbrella	5		
Settee or Glider	30		
Picnic Table	20		
Picnic Bench	5		
Outdoor Child's Slide	10		
Outdoor Child's Gym	20		
Outdoor Dryer Racks	5		
Outdoor Swings	30		
Portable Grill or Barbecue	10		
Porch Chair	10		
Rocker, Swing	15		
Rug, Large	7		
Rug, Small	3		
Settee	20		
Table	10		
Sand Box	10		
Wheelbarrow	8		

ARTICLE	Cu. Ft. Per Pc.	No. of Pieces	Cu. Ft.
MISCELLANEOUS			
Ash or Trash Can	7		
Basket (Clothes)	5		
Bicycle	10		
Bird Cage and Stand	5		
Card Table	1		
Cabinet, Filing	20		
Carriage, Baby	20		
Clothes, Hamper	5		
Cot, Folding	10		
Fan	5		
Fernery or Planter Stands	10		
Foot Lockers	5		
Golf Bag	3		
Heater, Gas or Elec.	5		
Incinerator	10		
Rollaway Bed	20		
Sled	2		
Step Ladder	5		
Tool Chest	10		
Tricycle	5		
Vacuum Cleaner	5		
Wagon, Child's	5		
Work Bench	20		
Carriage, Doll or Folding	5		
CONTAINERS			
Barrels	10		
Boxes, Wooden	3		
" "	5		
" "	10		
" "	15		
" "	20		
Carton	3		
"	5		
"	10		
Crates	5		
"	10		
"	15		
"	20		
"	25		
Wardrobe furnished by carrier	15		
TOTAL CUBIC FEET			

PACKING ESTIMATE	Qua.	Rate	Amount
Barrel, Drum or Fibre Container			
Boxes, Wooden not over cu. ft.			
Over not over cu. ft.			
Over Cu. Ft. (See Crates)			
Cartons: Not over			

To arrive at the Estimated Weight of the shipment, use a Weight Factor of seven pounds per cubic foot for the total cubic foot measurement derived.

Total cubic footage ____________ @ 7 lbs./cu. ft.= ____________ Estimated Weight

Remarks and/or Figures:

The shipper hereby declares valuation in ex-

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. a. $81.00
   b. $32.30
   c. $113.30
2. a. $88.25
   b. $32.30
   c. $120.55

Assignment Sheet #2

1.	a.	$45.00	b.	$52.50
2.	a.	$75.00	b.	$87.50
3.	a.	$15.00	b.	$17.50
4.	a.	$4.50	b.	$5.00
5.	a.	$139.50	b.	$162.50

Assignment Sheet #3

1.	a.	35	j.	30
	b.	10	k.	25
	c.	5	l.	25
	d.	45	m.	70
	e.	15	n.	25
	f.	22	o.	60
	g.	10	p.	10
	h.	20	q.	2
	i.	25	r.	434

2.		
	Column 1	690
	Column 2	776
	Total	1466

Assignment Sheet #4

1. $58.65
2. $400.40
3. $214.92
4. $300.00
5. $729.59

Assignment Sheet #5

Rate	Labor
25.50	6.00
9.75	2.25
38.00	6.00
25.00	25.00
7.00	3.80

1. $105.25
2. $43.05
3. $148.30
4. 20 cubic feet
5. $1.50
6. $30.00
7. 6643 lbs.
8. 67 CWTs
9. $10.01
10. $660.66
11. $40.00
12. a. $148.30
    b. $30.00
    c. $660.66
    d. $40.00
    e. $878.96

Alternate Assignment Sheet--Evaluated to the satisfaction of the instructor.

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

TEST

1. Match the terms on the right to the correct definition.

_____a. Used by movers to determine the number of cubic feet of space an item takes up

_____b. Contains prices for containers, barrels, rates for packing and crating, rates for any special services, and the transportation rate

_____c. Per hundred weight

_____d. Used to pack and ship china and other breakable items

_____e. Moving goods from one place to another place

_____f. The space goods take up when moving them

_____g. Cartons used to pack and ship clothes

_____h. Used to pack small items such as books, lamps

_____i. Used to crate and ship such items as end tables, coffee tables, night tables

_____j. Amount charged for shipping from the point where the load is picked up to the point of destination

_____k. Charge for any stop(s) made in excess of the initial pickup and delivery at final destination

1. Barrel
2. Boxes
3. CWT
4. Cartons
5. Comparison sheet
6. Delivery charge
7. Rate book
8. Shipping
9. Shipping space
10. Transportation rate
11. Wardrobe carton

2. List three reasons for keeping accurate records.

    a.

    b.

    c.

3. Name three jobs in the moving business that would use primary math skills.

    a.

    b.

    c.

4. Discuss steps in determining the cost for packing goods.

5. Demonstrate the ability to compute:

    a. Total packing cost.

    b. Total crating cost.

    c. Total transportation cost.

    d. Total delivery cost.

    e. Total cost of shipping goods.

    (NOTE: If this activity has not been completed prior to this test, ask the instructor when it should be completed.)

MATHEMATICS IN TRANSPORTATION
SHIPPERS OF HOUSEHOLD GOODS

ANSWERS TO TEST

1. a. 5
   b. 7
   c. 3
   d. 1
   e. 8
   f. 9
   g. 11
   h. 4
   i. 2
   j. 10
   k. 6
2. a. Reduces the possibility of errors
   b. Ensures proper income tax records
   c. Checks gains or losses of the company
3. Any three of the following are acceptable.
   a. Moving estimator
   b. Storage estimator
   c. Cargo agent
   d. Operations manager
4. Discussion should include these points.
   a. View items to be packed
   b. Estimate the kind and number of cartons and barrels to be used

c. Determine the total packing charges for items to be packed

d. Determine the labor charge for packing the cartons

e. Determine the total packing cost by adding the charges for cartons, barrels, and labor

5. Assignment sheets will be evaluated by the instructor.

MATHEMATICS IN COMMUNICATION
THE COMPUTER

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify the basic parts of a computer and jobs directly associated with a computer. He should be able to apply the rules for raising a base numeral to a designated power, expanding a numeral by powers of ten, and changing base ten numbers to base two numbers. He should be able to read a computer card and write a flow chart. This will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Identify the basic parts of a computer by matching part names with definitions.
2. Apply the rule for raising base numerals to a designated power.
3. Apply the rule for expanding a numeral by powers of ten.
4. Apply the rule for changing base ten numbers to base two numbers.
5. Identify jobs directly associated with a computer by matching the job description to the job.
6. Demonstrate the ability to:
    a. Read computer cards.
    b. Write a flow chart.

This unit was written by Linda Salter and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

MATHEMATICS IN COMMUNICATION
THE COMPUTER

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide students with objective sheet.

  B. Provide students with information, assignment, and job sheets.

  C. Make transparencies.

  D. Discuss terminal and specific objectives.

  E. Discuss information and assignment sheets.

  F. Direct students through the different learning paths for each specific objective.

  G. Assist students in completion of job sheet.

  H. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheets and complete each assignment sheet.

  C. Complete procedures in job sheet.

  D. Make sure you are able to perform according to the type of performance called for by each specific objective.

  E. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

  A. Objectives

  B. Information sheet

  C. Transparency masters

    1. TM 1--Basic Parts of a Computer

    2. TM 2--Computer Cards

D. Assignment sheets

1. Assignment Sheet #1--Raise Base Numerals to a Designated Power
2. Assignment Sheet #2--Expand Numerals by Powers of Ten
3. Assignment Sheet #3--Change Base Ten Numbers to Base Two Numbers
4. Assignment Sheet #4--Read a Computer Card

E. Answers to assignment sheets

F. Job Sheet #1--Write a Flow Chart

G. Test

H. Answers to test

II. References:

A. National Cash Register. *Data Processing Written for the Layman-- What Is Binary Arithmetic?*

B. National Cash Register. *Data Processing Written for the Layman-- What Is a Computer?*

C. *Mathematics for Secondary Schools.* Oklahoma City Public Schools, 1968.

D. U.S. Department of Labor, Manpower Administration. *Occupations in Computing Systems,* U.S. Government Printing Office, 1972.

E. *Intermediate Science Curriculum Study (A Programmed Text).* Dallas, Texas: Silver Burdett Publishing Company, 1970.

F. Eicholz and Daffer. *Elementary School Math.* New York: Addison-Wesley, 1968.

(NOTE: This includes three books, one for grade six, grade seven, and grade eight.)

G. Nichols, Flournoy, Kalen and Simon. *Elementary Math: Patterns and Structures.* New York: Holt Rinehart and Winston, 1966.

(NOTE: This includes four books, one for each of grades 5, 6, 7, and 8.)

H. Seymour, et. al. *Aftermath.* Palo Alto, California: Creative Publishers Inc., 1970.

(NOTE: This includes books 1, 2, 3, and 4.)

I. Dolciani, et. al. *Modern School Math.* New York: Houghton-Mifflin Company, 1967.

(NOTE: This includes four books, one for each of grades 5, 6, 7, and 8.)

MATHEMATICS IN COMMUNICATION
THE COMPUTER

INFORMATION SHEET

I. Basic parts of a computer (Transparency 1)

- A. Input unit--Takes information into the computer
- B. Optical reader--Reads code punched in cards
- C. Central processor--Processes information and stores it or uses it
- D. Console--Allows the operator to start and stop processing and gives commands to the computer
- E. Arithmetic unit--Performs the arithmetic functions
- F. Magnetic document sorter--Reads special magnetic ink symbols
- G. Memory unit--Stores information for further use
- H. Output unit--Puts out information and results

II. Rule for raising a base numeral to a designated power

Multiply the base numeral times itself the number of times expressed by the value of the exponent.

Example: 2^5 is read two to the fifth power.
2 is the base numeral.
5 is the exponent or the power.
The base numeral (2) multiplied by itself the number of times expressed by the value of the exponent (5) raises the base numeral 2 to its designated power of 5.
Another way of expressing this procedure is $2 \times 2 \times 2 \times 2 \times 2 = 2^5$ or 32.

III. Rule for expanding numerals by powers of ten

- A. Start at left side of number
- B. Determine the place value of left figure
- C. Write the figure as a product of the digit X power of 10 which names that place

INFORMATION SHEET

  D. Move to the right and complete steps 1, 2, and 3 on each figure

  E. As each digit is expanded by ten, indicate addition of that expansion to the next digit expansion

IV. Rule for changing base ten numbers to base two numbers

  A. Subtract successive powers of 2 (2, 4, 8, 16, 32...) from the base ten number

  B. Begin with the largest possible and continue to units

  C. Record each subtracted power, using zero as a place holder for those not subtracted

V. Jobs directly associated with a computer

  A. Key-punch operator and data typist -- Operate machines to convert materials into machine processable input

  B. Computer operator--Inserts material into the equipment and monitors machines during the processing

  C. Auxiliary equipment operator -- Operates electromechanical equipment, such as sorters, decollaters, and other office equipment

  D. Scheduler--Assigns specific computer runs to operators

  E. Tape librarian--Maintains a file of computer tapes or other standard input materials

VI. Read a computer card by reading the vertical columns (Transparency 2) under the horizontal digits at the top of the card

  A. Digits 1 through 80 are printed horizontally across the top of a computer card; each of these digits represents a vertical column

  B. Under each of these 80 digits or columns, numbers 1 through 9 are printed vertically

  C. Read only one vertical column at a time

  D. When there is only one hole punched in a vertical column, that hole represents a number

  E. The value of the number is determined by the number in the vertical column that is punched out (Example 1, Figure A)

  F. All letters, A-Z, are always represented by two holes punched in one of the vertical columns

INFORMATION SHEET

G. The letters are divided into three groups, A-I, J-R, and S-Z

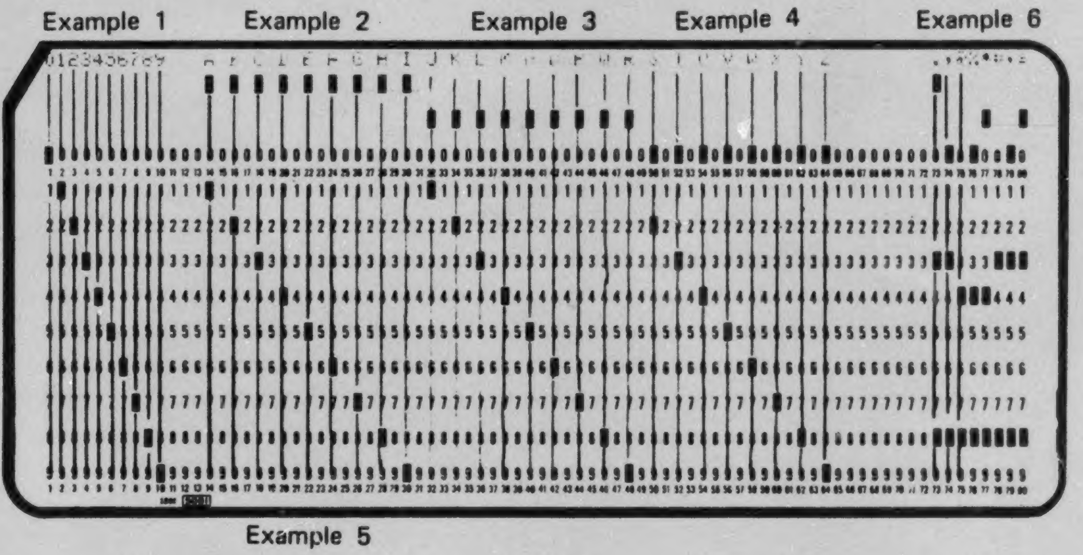
H. Each of these groups of letters has its top hole punched at a different level on the top of the card

1. Letters A-I have their top holes punched at the highest level (Example 2, Figure A)
2. Letters J-R have their top holes punched at the second level (Example 3, Figure A)
3. Letters S-Z have their top holes punched at the third level (Example 4, Figure A)

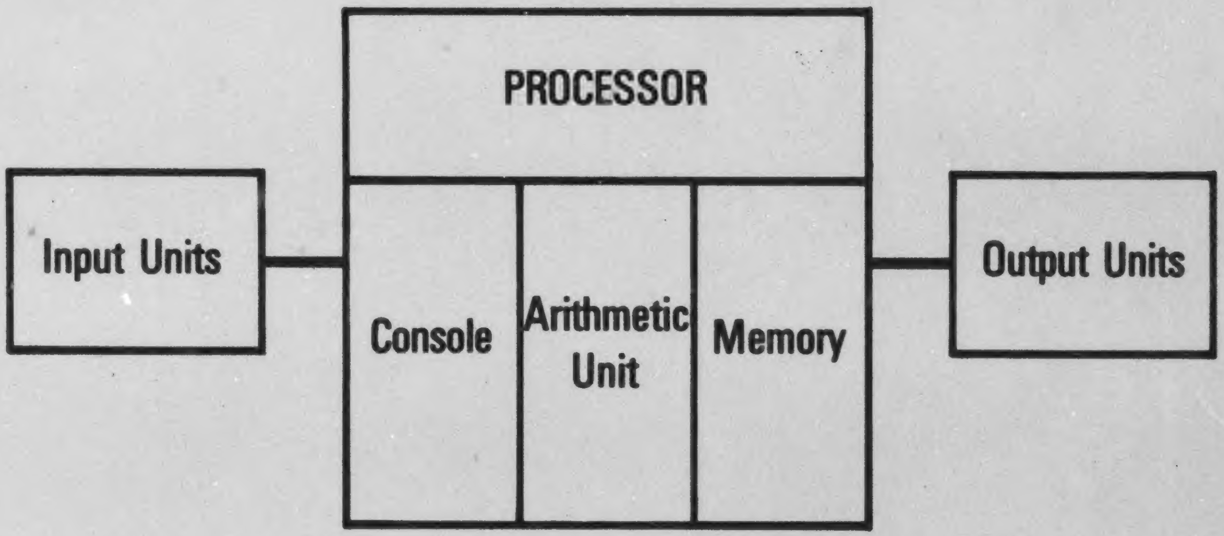
I. The position of the second hole in the vertical column determines which letter from each of the groups is printed in that column (Example 5, Figure A)

J. All punctuation marks are represented by three holes punched in the same vertical column (Example 6, Figure A)

FIGURE A


Example 1
Example 2
Example 3
Example 4
Example 6
0123456789
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Example 5

Basic Parts of a Computer



Input Units

PROCESSOR

Console

Arithmetic Unit

Memory

Output Units

Computer Cards

Figure 1

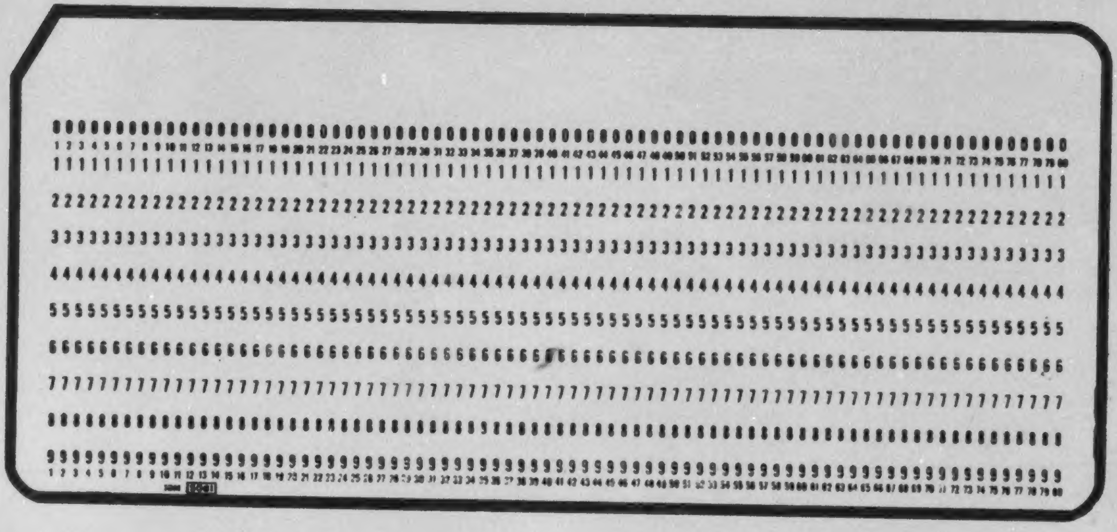


Figure 2

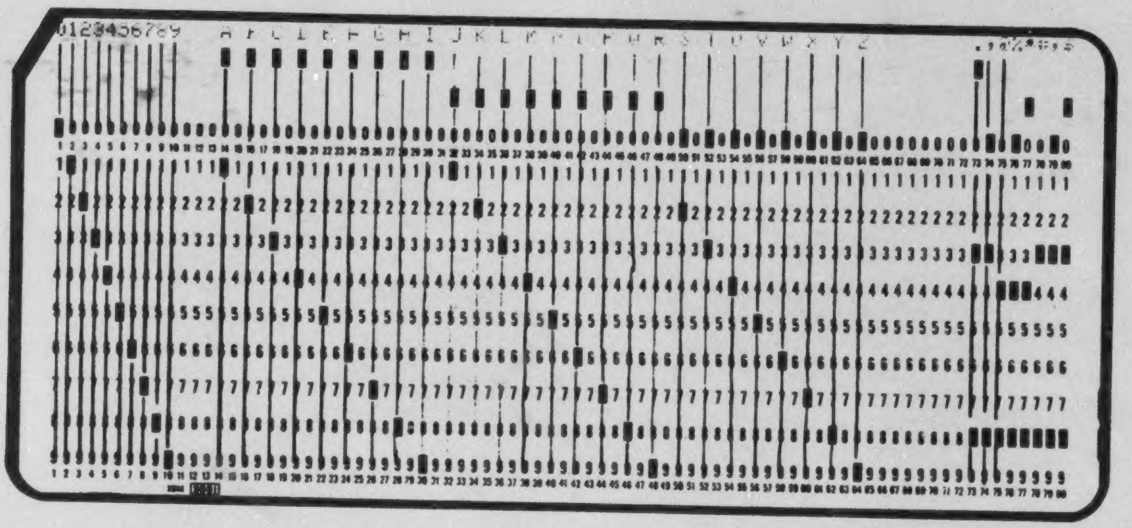

0123456789 ABCDEFGHIJKLMNOPQRSTUVWXYZ

Figure 3

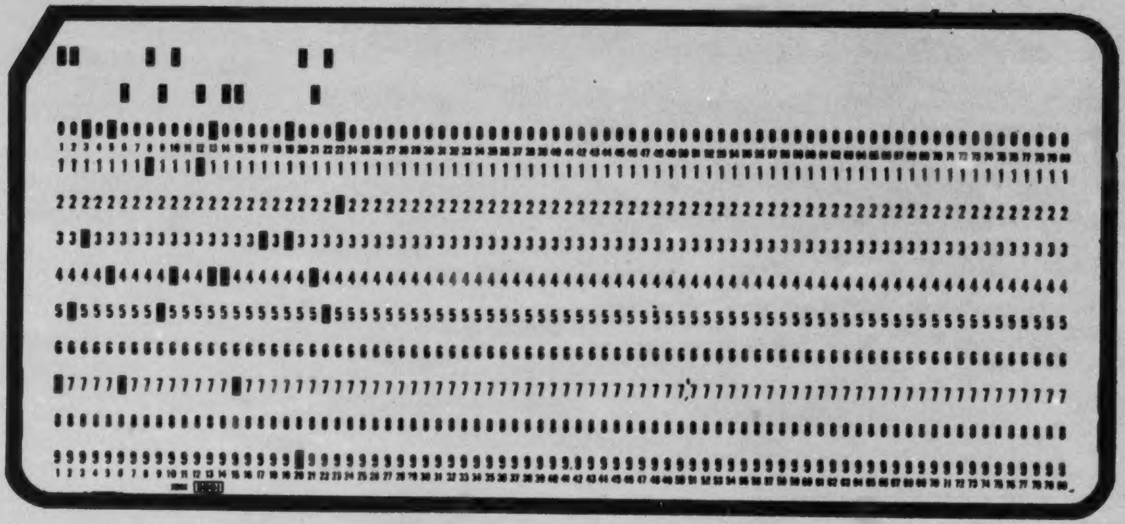
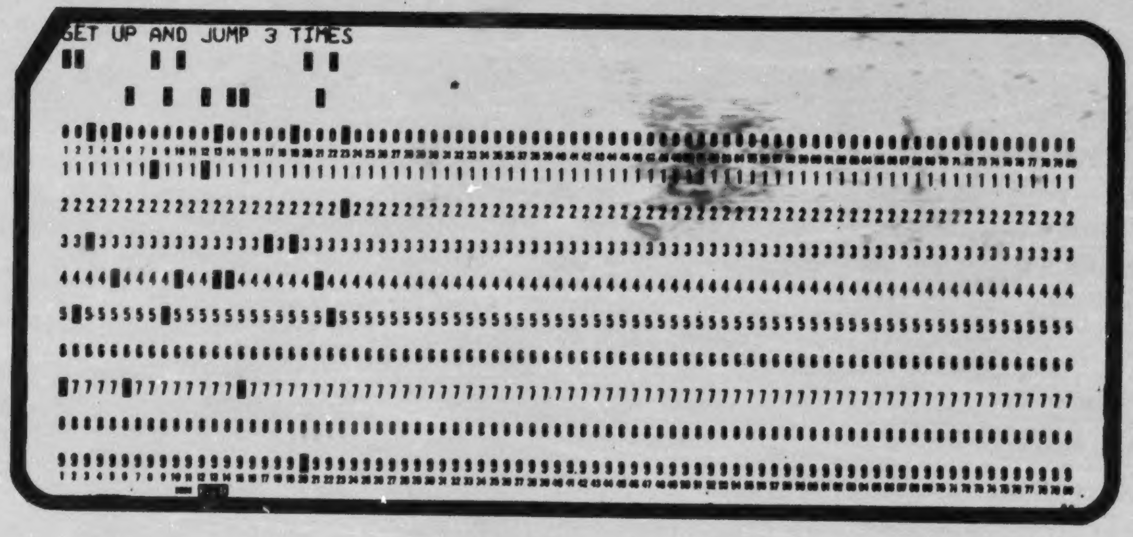


Figure 4


GET UP AND JUMP 3 TIMES

MATHEMATICS IN COMMUNICATION
THE COMPUTER

ASSIGNMENT SHEET #1–RAISE BASE NUMERALS TO A DESIGNATED POWER

The exponent tells us how many times the base is used as a factor.

1. What are the exponents in the following numbers?

   a. $2 \times 2 \times 2 \times 2 \times 2 = 2^a$ _____
   b. $3 \times 3 \times 3 = 3^c$ _____
   c. $4 \times 4 = 4^c$ _____
   d. $5 = 5^d$ _____
   e. 3^7 _____
   f. 5^4 _____

2. What are the bases in the following numbers?

   a. 10^6 _____
   b. 3^4 _____
   c. 36^3 _____
   d. 26^5 _____
   e. 5^{11} _____
   f. 3^1 _____

3. What are the standard numeral names for the following?

   a. 2^2 _____
   b. 2^3 _____
   c. 2^4 _____
   d. 2^5 _____
   e. 3^2 _____
   f. 5^1 _____
   g. 3^4 _____
   h. 4^3 _____
   i. 10^2 _____
   j. 10^3 _____
   k. 10^6 _____
   l. 10^4 _____

4. Show each of the following as a product. Example: $3^4 = 3 \times 3 \times 3 \times 3$.

   a. 10^3 _____
   b. 5^4 _____
   c. 2^6 _____
   d. 6^2 _____
   e. 7^3 _____
   f. 10^1 _____

5. For each of the following write a number consisting of 1, followed by the correct number of zeroes. Example: 10^6 = 1,000,000

   a. 10^3 _____
   b. 10^5 _____
   c. 10^4 _____
   d. 10^7 _____

6. Write the following using 10 with the correct exponent.

   a. 10,000 _____
   b. 100,000 _____
   c. 10 _____
   d. 100 _____

MATHEMATICS IN COMMUNICATION
THE COMPUTER

ASSIGNMENT SHEET #2--EXPAND NUMERALS BY POWERS OF TEN

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
10^6	10^5	10^4	10^3	10^2	10^1	10^0

1 Followed by No Zeroes = $10^0 = 1$
1 Followed by One Zero = $10^1 = 10$
1 Followed by Two Zeroes = $10^2 = 100$
1 Followed by Three Zeroes = $10^3 = 1000$
1 Followed by Four Zeroes = $10^4 = 10{,}000$

1. Answer the following questions.

______a. In 219, what is the value of 2?

______b. In 26, what is the value of 2?

______c. In 2, what is the value of 2?

______d. In 200, what is the value of 2?

______e. In 2,159, what is the value of 2?

Expanding a numeral by powers of ten shows the decimal (ten) nature of our base ten system. $26{,}039 = (2 \times 10^4) + (6 \times 10^3) + (0 \times 10^2) + (3 \times 10^1) + (9 \times 10^0)$. It is not necessary to write (0×10^2) since it equals 0.

2. Expand the following by powers of ten.

a. 461

b. 1,025

c. 536,879

d. 67,080

e. 5,368,972

f. 40,321

ASSIGNMENT SHEET #2

3. Given an expansion by powers of ten, write each numeral in standard form.

Example: $(2 \times 10^5) + (1 \times 10^3) + (4 \times 10^2) + (3 \times 10^1) + (5 \times 10^0) = 201{,}435$

__________ a. $(1 \times 10^4) + (3 \times 10^3) + (2 \times 10^0) =$

__________ b. $(5 \times 10^5) + (9 \times 10^4) + (6 \times 10^1) =$

__________ c. $(9 \times 10^7) + (3 \times 10^6) + (8 \times 10^5) + (1 \times 10^4) + (8 \times 10^3) + (3 \times 10^0) =$

__________ d. $(1 \times 10^9) + (1 \times 10^6) + (1 \times 10^3) + (1 \times 10^0) =$

4. Write the following in exponential form.

_____ a. 2 x 2 x 2 x 2 x 2

_____ b. 1 x 1 x 1

_____ c. 37 x 37 x 37 x 37

_____ d. 10 x 10

5. Expand by powers of ten.

a. 1, 059 ______________________________

b. 976 ______________________________

c. 100,106 ______________________________

d. 67,321 ______________________________

e. 7,003,010 ______________________________

f. 333,333 ______________________________

6. Given an expansion by powers of ten, write each numeral in standard form.

__________ a. $(6 \times 10^3) + (9 \times 10^2) + (7 \times 10^1) + (3 \times 10^0)$

__________ b. $(9 \times 10^5) + (1 \times 10^3) + (8 \times 10^1)$

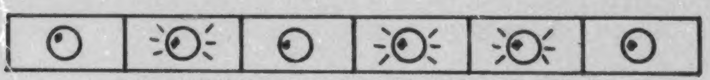
__________ c. $(8 \times 10^6) + (9 \times 10^0)$

__________ d. $(3 \times 10^7) + (5 \times 10^1)$

MATHEMATICS IN COMMUNICATION
THE COMPUTER

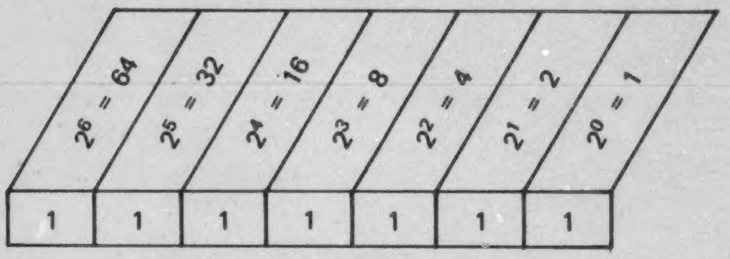
ASSIGNMENT SHEET #3--CHANGE BASE TEN NUMBERS TO BASE TWO NUMBERS

BINARY ARITHMETIC. "BI" means "two." There are only 2 digits in the Binary System - 0 and 1. Because an electric current has two possibilities - either it flows or it doesn't - the Binary System is suitable for electronic computers. We may show the digits in each place by a light. If the light is on for any place, there is a 1 in the place; if the light is not on, there is a zero in the place.



THE ABOVE DIAGRAM SHOWS 10110

PLACE VALUE CHART FOR BASE TWO



Study the record of counting from one through fifteen shown in the Binary System below.

Base Ten	Base Two	Value
1	1	1 one
2	10	(1 two) + (0 ones)
3	11	(1 two) + (1 one)
4	100	(1 four) + (0 two) + (0 ones)
5	101	(1 four) + (0 twos) + (1 one)
6	110	(1 four) + (1 two) + (0 ones)
7	111	(1 four) + (1 two) + (1 one)
8	1000	(1 eight) + (0 fours) + (0 twos) + (0 ones)
9	1001	(1 eight) + (0 fours) + (0 twos) + (1 one)
10	1010	(1 eight) + (0 fours) + (1 two) + (0 ones)
11	1011	(1 eight) + (0 fours) + (1 two) + (1 one)
12	1100	(1 eight) + (1 four) + (0 twos) + (0 ones)
13	1101	(1 eight) + (1 four) + (0 twos) + (1 one)
14	1110	(1 eight) + (1 four) + (1 two) + (0 ones)
15	1111	(1 eight) + (1 four) + (1 two) + (1 one)

ASSIGNMENT SHEET #3

1. Continue the above chart through 30.

	Base Ten	Base Two	Value
a.	16		
b.	17		
c.	18		
d.	19		
e.	20		
f.	21		
g.	22		
h.	23		
i.	24		
j.	25		
k.	26		
l.	27		
m.	28		
n.	29		
o.	30		

2. Give the value of each basic numeral. Then write the name of the number in base-ten notation.

Example: 1010_{two} = (1 eight) + (0 fours) + (1 two) + (0 one) = 10_{ten}

a. 10_{two}

b. 11_{two}

c. 101_{two}

d. 1111_{two}

e. 1000_{two}

f. 1011_{two}

ASSIGNMENT SHEET #3

3. Write the value of the 1 in the following:

a. $10,000_{\text{two}}$ ______ b. $100,000_{\text{two}}$ ______ c. $1,000,000_{\text{two}}$ ______

4. Name the binary numerals with decimal numerals.

a. 10_{two} ____________

b. 101_{two} ____________

c. 111_{two} ____________

d. 1001_{two} ____________

e. 1100_{two} ____________

f. 1111_{two} ____________

g. 10000_{two} ____________

h. 10011_{two} ____________

i. 10111_{two} ____________

j. 100011_{two} ____________

5. Use binary numerals to name the decimal numerals.

a. 4_{ten} ____________

b. 7_{ten} ____________

c. 10_{ten} ____________

d. 11_{ten} ____________

e. 18_{ten} ____________

f. 21_{ten} ____________

g. 24_{ten} ____________

h. 32_{ten} ____________

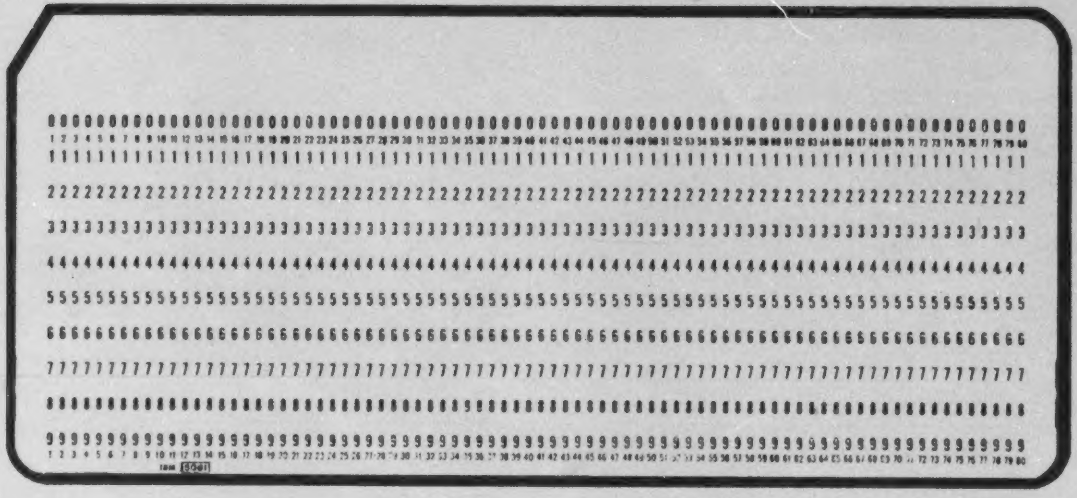
i. 41_{ten} ____________

j. 50_{ten} ____________

MATHEMATICS IN COMMUNICATION
THE COMPUTER

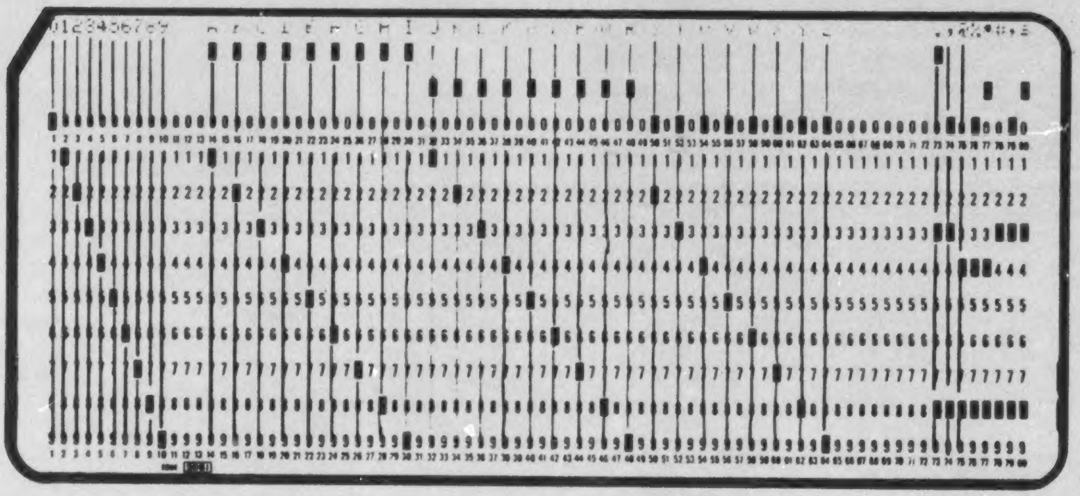
ASSIGNMENT SHEET #4--READ A COMPUTER CARD

This is a computer card. In some form or another you have seen a lot of them around. Your telephone bill, your electric bill, your natural gas bill are all computer cards.



Perhaps you can think of some other places where computer cards are used. These computer cards are all used to give computers some specific information about you or your family.

What is the difference between the card shown below and the one above?



ASSIGNMENT SHEET #4

Right now you probably think this one just has a lot of holes in it. This is true. Each hole has a significant meaning to the computer. The holes in this card give the computer some specific information.

Notice that there are numbers printed horizontally across the card from 1 to 80 with a column of vertical numbers going between the ones in column 1, between the two's in column 2, etc., all the way to column 80. The card reader on a computer only reads one column at a time.

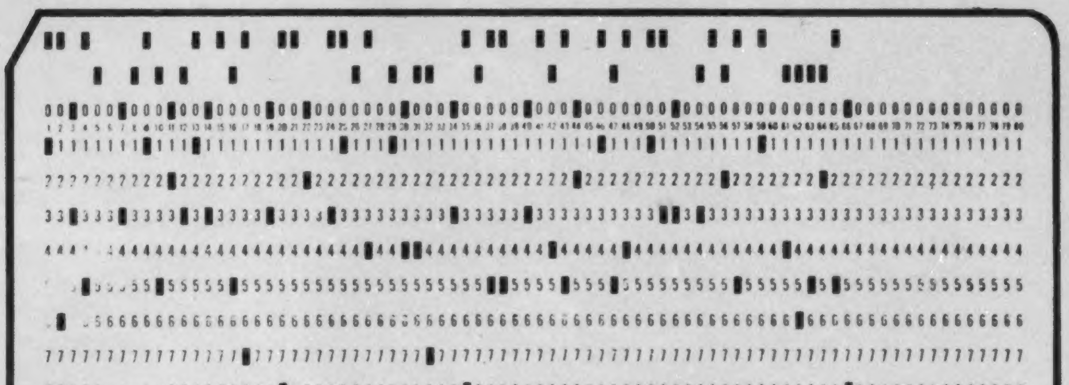
Look at the key card; in the first column you will notice there is only one hole punched and the hole is where the zero would be in that column. This column represents the number zero. Look at the second column; again there is only one hole, but this time the one is punched out. This column represents the number one. Look on down through column 10; all the numbers 0-9 are punched out. A number will always be represented by only one hole in a vertical column.

Look at column 14; the first thing you will notice is that there are 2 holes punched in the vertical column. All letters A-Z will be represented by 2 holes punched in the vertical column. Notice that the letters A-I all have their top holes on the same level and letters S-Z all have their top holes on the same level.

Look at Column 73; you will notice that there are 3 holes punched in the vertical columns here. If you find a vertical column with 3 holes punched out it always represents a punctuation mark. The location of the punches for different punctuations are shown on the key card.

A computer reads cards by the holes punched in them. You can also read cards by the holes punched in them. Try to read the card shown below--refer to your key for help.

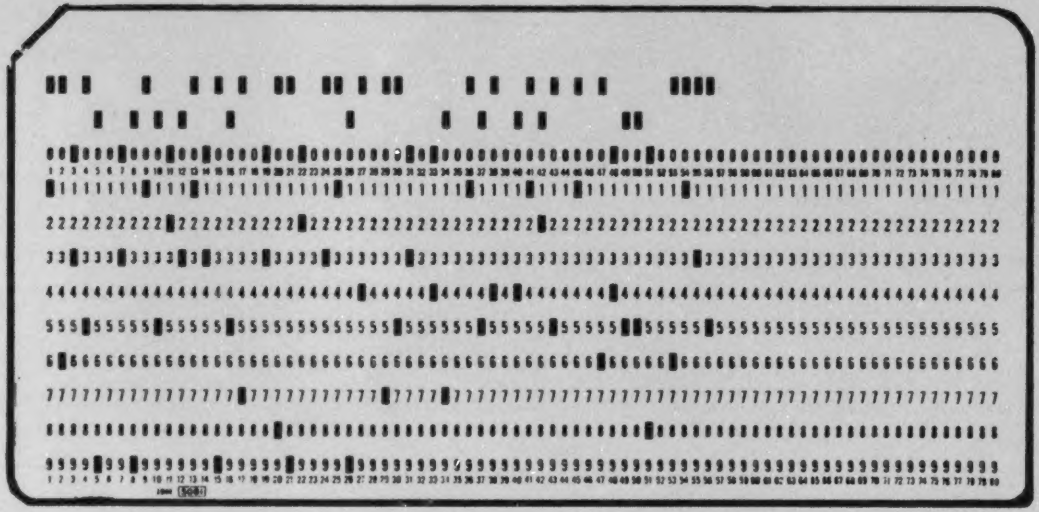
1.



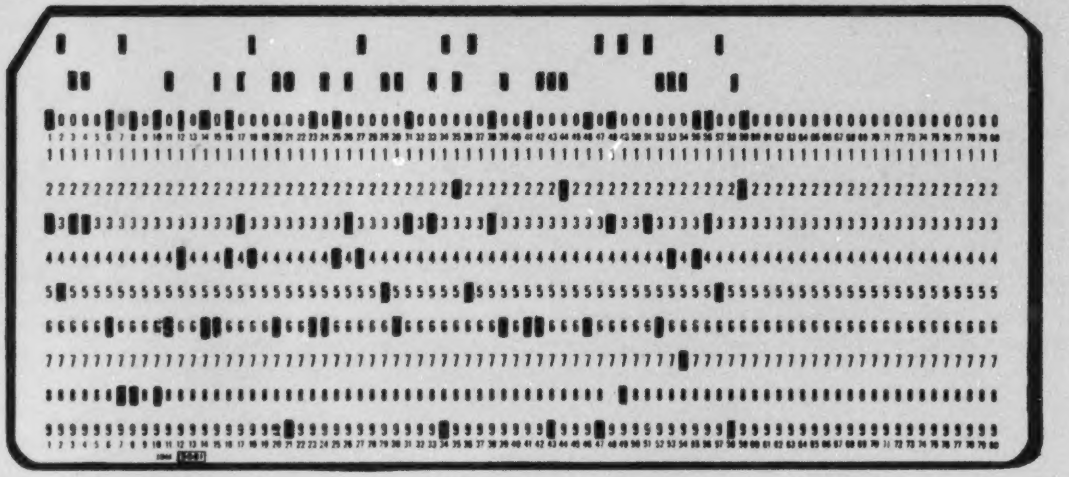
ASSIGNMENT SHEET #4

Your teacher will help you with this card. Now that you have tried one, translate the following cards and write your answers in the spaces below each card.

2.

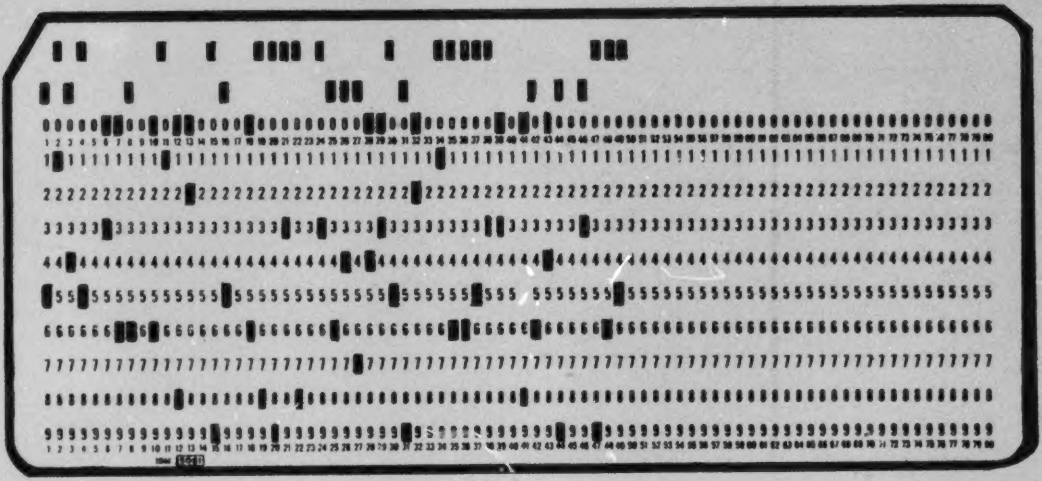


3.

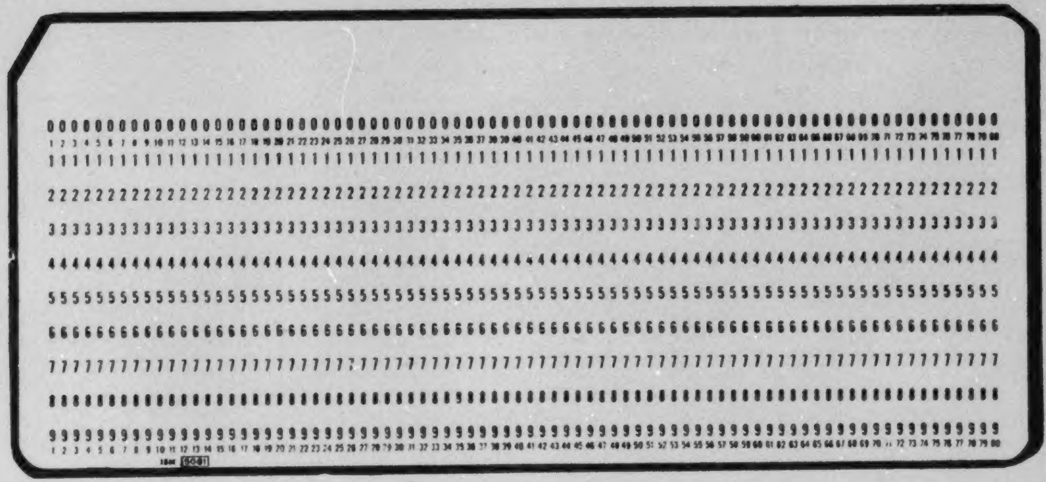


ASSIGNMENT SHEET #4

4.



5. Use the blank computer card below to code your own message. Exchange cards with a partner and read the message on the card you receive.



MATHEMATICS IN COMMUNICATION
THE COMPUTER

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. a. 5 d. 1
   b. 3 e. 7
   c. 2 f. 4
2. a. 10 d. 26
   b. 3 e. 5
   c. 36 f. 3
3. a. 4 e. 9 i. 100
   b. 8 f. 5 j. 1000
   c. 16 g. 81 k. 1,000,000
   d. 32 h. 64 l. 10,000
4. a. 10 x 10 x 10 d. 6 x 6
   b. 5 x 5 x 5 x 5 e. 7 x 7 x 7
   c. 2 x 2 x 2 x 2 x 2 x 2 f. 10
5. a. 1000
   b. 100,000
   c. 10,000
   d. 10,000,000
6. a. 10^4
   b. 10^5
   c. 10^1
   d. 10^2

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #2

1. a. 200
   b. 20
   c. 2
   d. 200
   e. 2000
2. a. $(4 \times 10^2) + (6 \times 10^1) + (1 \times 10^0)$
   b. $(1 \times 10^3) + (2 \times 10^1) + (5 \times 10^0)$
   c. $(5 \times 10^5) + (3 \times 10^4) + (6 \times 10^3) + (8 \times 10^2) + (7 \times 10^1) + (9 \times 10^0)$
   d. $(6 \times 10^4) + (7 \times 10^3) + (8 \times 10^1)$
   e. $(5 \times 10^6) + (3 \times 10^5) + (6 \times 10^4) + (8 \times 10^3) + (9 \times 10^2) + (7 \times 10^1) + (2 \times 10^0)$
   f. $(4 \times 10^4) + (3 \times 10^2) + (2 \times 10^1) + (1 \times 10^0)$
3. a. 13,002
   b. 590,060
   c. 93,818,003
   d. 1,001,001,001
4. a. 2^5
   b. 1^3
   c. 37^4
   d. 10^2
5. a. $(1 \times 10^3) + (5 \times 10^1) + (9 \times 10^0)$
   b. $(9 \times 10^2) + (7 \times 10^1) + (6 \times 10^0)$
   c. $(1 \times 10^5) + (1 \times 10^2) + (6 \times 10^0)$
   d. $(6 \times 10^4) + (7 \times 10^3) + (3 \times 10^2) + (2 \times 10^1) + (1 \times 10^0)$

ANSWERS TO ASSIGNMENT SHEETS

e. $(7 \times 10^6) + (3 \times 10^3) + (1 \times 10^1)$

f. $(3 \times 10^5) + (3 \times 10^4) + (3 \times 10^3) + (3 \times 10^2) + (3 \times 10^1) + (3 \times 10^0)$

6. a. 6,973

b. 901,080

c. 8,000,009

d. 30,000,050

Assignment Sheet #3

1.	a.	16	10000	(1 sixteen) + (0 eights) + (0 fours) + (0 twos) + (0 ones)
	b.	17	10001	(1 sixteen) + (0 eights) + (0 fours) + (0 twos) + (1 one)
	c.	18	10010	(1 sixteen) + (0 eights) + (0 fours) + (1 two) + (0 ones)
	d.	19	10011	(1 sixteen) + (0 eights) + (0 fours) + (1 two) + (1 one)
	e.	20	10100	(1 sixteen) + (0 eights) + (1 four) + (0 twos) + (0 ones)
	f.	21	10101	(1 sixteen) + (0 eights) + (1 four) + (0 twos) + (1 one)
	g.	22	10110	(1 sixteen) + (0 eights) + (1 four) + (1 two) + (0 ones)
	h.	23	10111	(1 sixteen) + (0 eights) + (1 four) + (1 two) + (1 one)
	i.	24	11000	(1 sixteen) + (1 eights) + (0 fours) + (0 twos) + (0 ones)
	j.	25	11001	(1 sixteen) + (1 eight) + (0 fours) + (0 twos) + (1 one)
	k.	26	11010	(1 sixteen) + (1 eight) + (0 fours) + (1 two) + (0 one)
	l.	27	11011	(1 sixteen) + (1 eight) + (0 fours) + (1 two) + (1 one)
	m.	28	11100	(1 sixteen) + (1 eight) + (1 four) + (0 twos) + (0 ones)
	n.	29	11101	(1 sixteen) + (1 eight) + (1 four) + (0 twos) + (1 one)
	o.	30	11110	(1 sixteen) + (1 eight) + (1 four) + (1 two) + (0 one)

ANSWERS TO ASSIGNMENT SHEETS

2. a. (1 two) + (0 ones) = 2
   b. (1 two) + (1 one) = 3
   c. (1 four) + (0 twos) + (1 one) = 5
   d. (1 eight) + (1 four) + (1 two) + (1 one) = 15
   e. (1 eight) + (0 fours) + (0 twos) + (0 ones) = 8
   f. (1 eight) + (0 fours) + (1 two) + (1 one) = 11

3. a. 16
   b. 32
   c. 64

4. a. 2
   b. 5
   c. 7
   d. 9
   e. 12
   f. 15
   g. 16
   h. 19
   i. 23
   j. 35

5. a. 100_{two}
   b. 111_{two}
   c. 1010_{two}
   d. 1011_{two}
   e. 10010_{two}
   f. 10101_{two}
   g. 11000_{two}
   h. 100000_{two}
   i. 101001_{two}
   j. 110010_{two}

Assignment Sheet #4

1. After translating this card jump three times and act like a monkey.
2. After translating this card, get up and make a funny face.
3. Tell why you would or would not like to work with computers.
4. Name two ways in which computers affect your life.
5. Answers will vary.

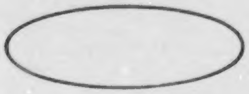
MATHEMATICS IN COMMUNICATION
THE COMPUTER

JOB SHEET #1--WRITE A FLOW CHART

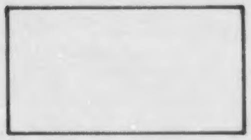
I. A computer can perform only one operation at a time, so it is necessary to develop programmed instructions in linear order so that various operations can be performed. Each particular solution of the problem must be programmed in a consecutive pattern. A method called "flow charting" has been developed so that this pattern can be visualized and retained.

A. The following standardized symbols are used when making flow charts.

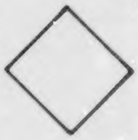
1. A loop indicates start-input-output and end.



2. A box indicates information or action.



3. A diamond indicates question or decision that may be answered "yes" or "no."

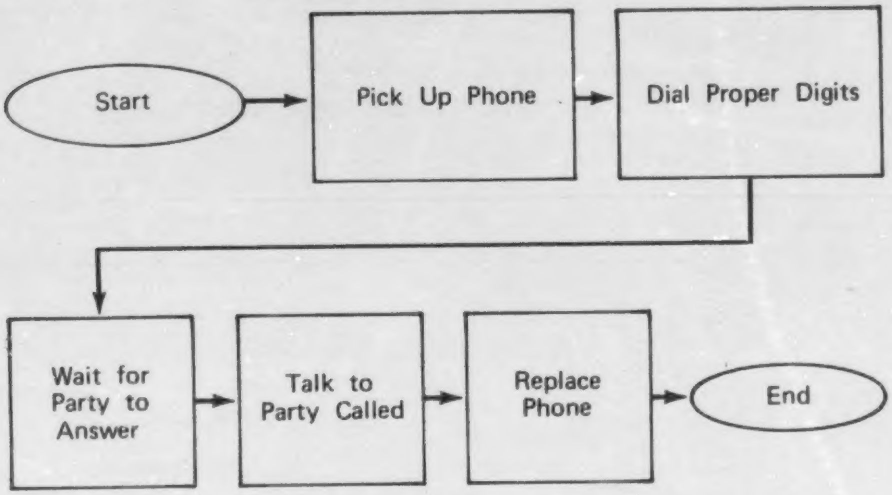


B. Problem solving does occur in areas other than mathematics. Flow charting will be introduced with a nonmathematical concept. A good example to begin with is making a phone call. What are some steps involved?

1. Pick up the phone
2. Dial proper digits
3. Wait for party to answer
4. Talk to party called
5. Replace phone

JOB SHEET #1

C. The following is a simple flow chart for making a phone call.

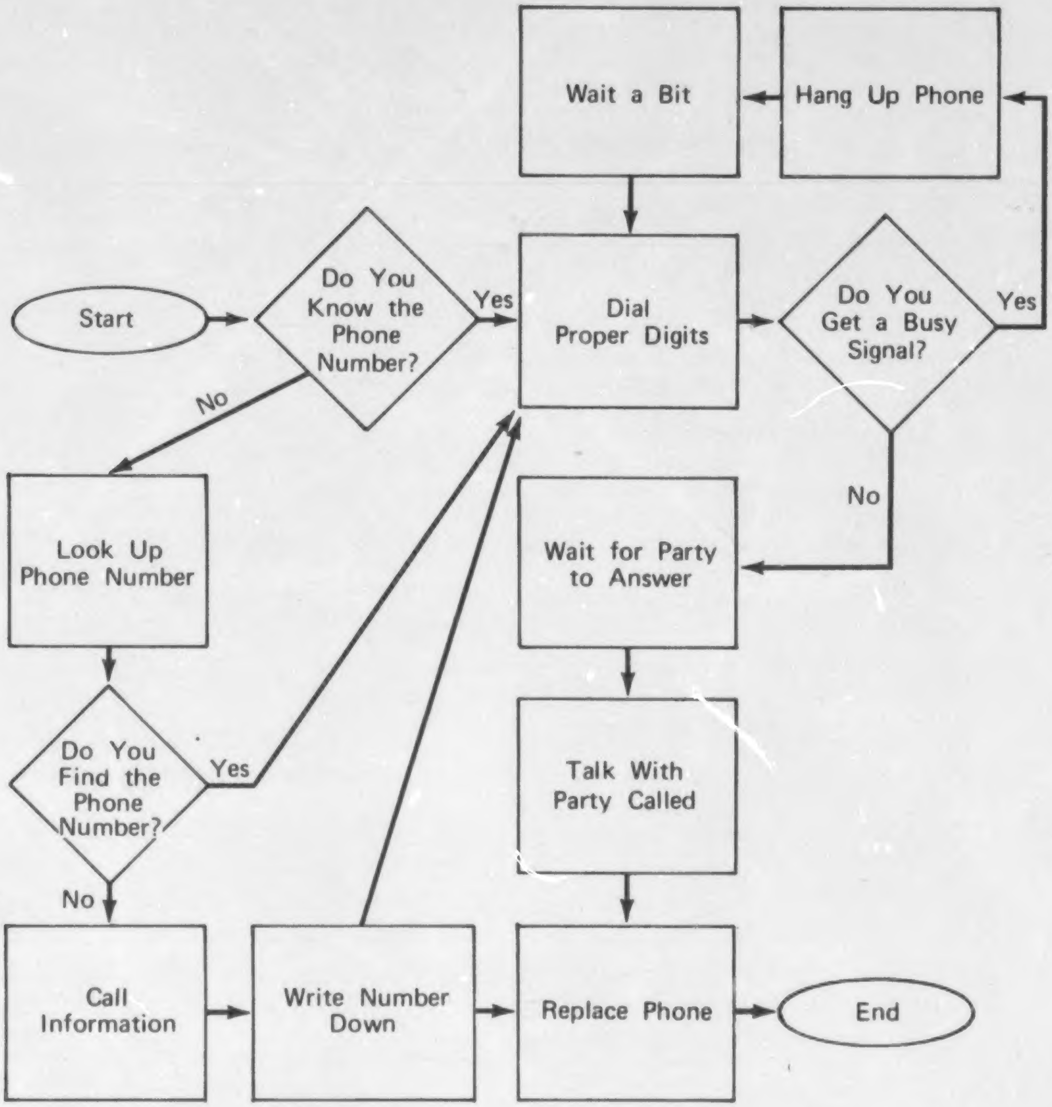

Start
Pick Up Phone
Dial Proper Digits
Wait for Party to Answer
Talk to Party Called
Replace Phone
End

There might be more details in making a phone call, such as:

1. Do you know the phone number?
    a. Yes - Dial the proper digits
        1) Do you get a busy signal?
        2) Yes--Hang up the phone
        3) Wait a bit--Go to 1-a again
        4) No--Wait for the party to answer
        5) Talk with party called
        6) Replace phone
    b. No - Look up phone number
        1) Do you find the number?
        2) Yes--Go to 1-a
        3) No--Call information
        4) Write phone number down
        5) Go to 1-a again

JOB SHEET #1

2. This flow chart might look like this:


Start
Do You Know the Phone Number?
Yes
No
Dial Proper Digits
Wait a Bit
Hang Up Phone
Do You Get a Busy Signal?
Yes
No
Look Up Phone Number
Do You Find the Phone Number?
Yes
No
Wait for Party to Answer
Talk With Party Called
Call Information
Write Number Down
Replace Phone
End

JOB SHEET #1

D. Make all flow charts neat and easy to read. Keep them alphabetized in a notebook to be referred to again if help is needed. All flow charts to be kept must be checked by the teacher for accuracy. It is well to remember that flow charts are an individual process, and there is really no one flow chart for any given problem.

II. Make flow charts for two of these situations or two of your own choice

A. How to open a car door

B. How to put on a blouse or shirt

C. How to put your hair on rollers

D. How to roller skate

E. How to dust a table

F. How to get a special book from the library

G. How to start a lawn mower

H. How to back a car out of a tight parking place--Parallel, that is

I. How to make a bed

J. How to start a car

K. How to write a short note and pass it without teacher seeing

L. How to open a desk drawer

M. How to get a drink of water

N. How to buy a notebook

O. How to make an appointment with a dentist

P. How to mow a lawn

MATHEMATICS IN COMMUNICATION
THE COMPUTER

TEST

1. Identify the basic parts of a computer by matching the part names on the right to the definitions on the left.

_____a. Performs the arithmetic functions

_____b. Stores information for further use

_____c. Reads code punched in cards

_____d. Takes information into the computer

_____e. Processes information and stores it or uses it

_____f. Reads special magnetic ink symbols

_____g. Puts out information and results

1. Memory unit
2. Output unit
3. Input unit
4. Arithmetic unit
5. Central processor
6. Magnetic document sorter
7. Optical reader

2. Apply the rule for raising base numerals to a designated power to solve the following problems.

a. Write the following as one number:

1) 2^5 = _____

2) 3^6 = _____

3) 6^4 = _____

4) 4^2 = _____

5) 9^1 = _____

6) 8^2 = _____

7) 3 x 3 x 3 x 3 = _____

8) 5 x 5 = _____

b. Write the following with a base of 10 and the correct exponent:

1) 10,000 = __________

2) 100,000 = __________

3) 1,000 = __________

4) 100 = __________

3. Apply the rule for expanding a numeral by powers of ten to solve the following problems. Instructions are given for each group of problems.

   a. Expand by powers of 10

      1) 5,321

      2) 31,563

      3) 133,532

      4) 14,563

      5) 232

   b. Write the following expansions of ten in standard numeral form.

      1) $(1 \times 10^3) + (3 \times 10^2) + (7 \times 10^1) + (4 \times 10^0) =$

      2) $(7 \times 10^6) + (5 \times 10^5) + (8 \times 10^3) + (9 \times 10^2) + (4 \times 10^1) =$

      3) $(3 \times 10^5) + (3 \times 10^4) + (3 \times 10^3) + (3 \times 10^2) + (3 \times 10^1) + (3 \times 10^0) =$

      4) $(5 \times 10^4) + (2 \times 10^0) =$

      5) $(3 \times 10^0) =$

4. Apply the rule for changing base ten numbers to base two numbers to solve the following problems.

   a. 4_{ten}

   b. 11_{ten}

   c. 21_{ten}

   d. 32_{ten}

   e. 50_{ten}

5. Identify jobs directly associated with a computer by matching the job description on the left to the jobs on the right.

______a. Assigns specific computer runs to operators

______b. Inserts material into the equipment and monitors machines during processing

______c. Operates machines to convert materials into machine processable input

______d. Maintains a file of computer tapes or other standard input materials

______e. Operates electromechanical equipment such as sorters, reproducers, decollaters, and other office equipment

1. Scheduler
2. Key-punch operator or data typist
3. Computer operator
4. Auxiliary equipment operator
5. Tape librarian

6. Demonstrate the ability to:

   a. Read computer cards.

   b. Write a flow chart.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

MATHEMATICS IN COMMUNICATION
THE COMPUTER

ANSWERS TO TEST

1. a. 4
   b. 1
   c. 7
   d. 3
   e. 5
   f. 6
   g. 2
2. a. 1) 32
      2) 729
      3) 1296
      4) 16
      5) 9
      6) 64
      7) 81
      8) 25
   b. 1) 10^4
      2) 10^5
      3) 10^3
      4) 10^2
3. a. 1) $(5 \times 10^3) + (3 \times 10^2) + (2 \times 10^1) + (1 \times 10^0)$
      2) $(3 \times 10^4) + (1 \times 10^3) + (5 \times 10^2) + (6 \times 10^1) + (3 \times 10^0)$
      3) $(1 \times 10^5) + (3 \times 10^4) + (3 \times 10^3) + (5 \times 10^2) + (3 \times 10^1) + (2 \times 10^0)$

4) $(1 \times 10^4) + (4 \times 10^3) + (5 \times 10^2) + (6 \times 10^1) + (3 \times 10^0)$

5) $(2 \times 10^2) + (3 \times 10^1) + (2 \times 10^0)$

b. 1) 1,374

2) 7,508,940

3) 333,333

4) 50,002

5) 3

4. a. 100_{two}

b. 1011_{two}

c. 10101_{two}

d. 100000_{two}

e. 110010_{two}

5. a. 1

b. 3

c. 2

d. 5

e. 4

6. Performance skills evaluated to the satisfaction of the instructor.

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to measure length using metric units. He should be able to change from one metric unit to another. He should be able to manufacture and use a metric measuring device. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Convert common fractions to decimals.
2. Apply the rule for multiplying decimal fractions by powers of ten.
3. Match terms and definitions associated with metric measure.
4. Determine distances using the metric system of measuring.
5. Convert metric units to equivalent smaller or larger units.
6. Demonstrate the ability to manufacture and use a metric measuring device.

This unit was written by Eloise Chiu and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

SUGGESTED ACTIVITIES

I. Instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and assignment sheets.

  C. Discuss terminal and specific objectives.

  D. Discuss information and assignment sheets.

  E. Demonstrate and discuss procedures outlined in the job sheets.

  F. Give test.

II. Student:

  A. Read objective sheet.

  B. Study information sheet and complete each assignment sheet.

  C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

  D. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

  A. Objectives

  B. Information sheet

  C. Transparency master: TM 1--Metric Measure

  D. Bulletin board ideas

  E. Assignment sheets

    1. Assignment Sheet #1--Convert Common Fractions to Decimal Fractions

    2. Assignment Sheet #2--Apply the Rule for Multiplying Decimal Fractions by Powers of Ten

3. Assignment Sheet #3--Determine Distance Using the Metric System of Measuring

4. Assignment Sheet #4--Convert Metric Units to Equivalent Larger or Smaller Units

F. Answers to assignment sheets

G. Job sheets

1. Job Sheet #1--Construct a Measuring Device

2. Job Sheet #2--Indirect Measurements

H. Test

I. Answers to test

II. References

A. Vervoort, Gerardeis. *Mathematics Teacher,* "Inching Our Way Toward the Metric System." Vol. 66, No. 4, Washington D. C.: National Council of Teachers of Mathematics, April 1973, pp. 297-301.

B. *Arithmetic Teacher,* Vol. 20, No. 4, Washington D. C.: National Council of Teachers of Mathematics, April 1973.

C. *Mathematics for Secondary Schools.* Oklahoma City Public Schools, 1968.

D. Patterson, William Jr. *Arithmetic Teacher,* "A Device for Indirect Measurement: An Interesting Individual Project," Vol. 20, No. 2, Washington D. C.: National Council of Teachers of Mathematics, February 1973, pp. 124-127.

E. Eicholz and Daffer. *Elementary School Math.* New York: Addison-Wesley, 1968.

(NOTE: This includes three books, one for grade six, grade seven, and grade eight.)

F. Nichols, Flournoy, Kalen and Simon. *Elementary Math: Patterns and Structures.* New York: Holt Rinehart and Winston, 1966.

(NOTE: This includes four books, one for each of grades 5, 6, 7, and 8.)

G. Seymour, et. al, *Aftermath.* Palo Alto, California: Creative Publishers Inc., 1970.

(NOTE: This includes books 1, 2, 3, and 4)

H. Dolciani, et. al. *Modern School Math.* New York: Houghton-Mifflin Company, 1967.

(NOTE: This includes four books, one for each of grades 5, 6, 7, and 8.)

III. Optional Teaching Aids

The April, 1973, Volume 20, Number 4 issue of the *Arithmetic Teacher* is devoted entirely to metrication. It has many interesting articles and activities. This issue also gives the address where you can obtain the following materials at a cost of $3.00:

A. One 20 cm plastic ruler

B. Two 1.5m plastic, flexible measuring tapes

C. Two copies of "Metric Units of Measure," a booklet

D. One copy of *Metric Supplement to Science and Mathematics,* a workbook for use by the teacher and pupil.

E. One GOMETRIC bumper sticker

The address is:

Metric Association
2004 Ash Street
Waukegan, Illinois 60085

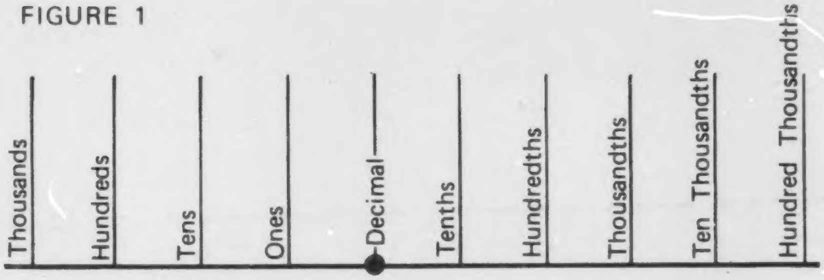
MATHEMATICS IN MANUFACTURING
METRIC MEASURE

INFORMATION SHEET

I. Convert common fractions to decimal fractions

(NOTE: The ideas of using the concept of place value to name certain fractions came to us from Simon Stevin. He was a surveyor using metric units to measure areas of land in much the same you will use the measuring instrument you will make later in the unit. Since his measurements were in the metric system and it is based on 10, many of his notations were fractions with a power of 10 for a denominator. He conceived the idea of extending our place value to the right of the decimal point and writing decimal fractions using standard digits.) (See Figure 1 below.)

FIGURE 1


Thousands
Hundreds
Tens
Ones
Decimal
Tenths
Hundredths
Thousandths
Ten Thousandths
Hundred Thousandths

A. Using the figures in Figure 1 we can write

1. 2/10 as .2
2. 2/100 as .02
3. 2/1000 as .002
4. 2/10000 as .0002
5. 2/100000 as .00002

B. The place the digit occupies determines its denominator and consequently its value.

1. 1.5 = 1 5/10 = 15/10=3/2
2. 2.67 = 2 67/100 = 267/100
3. 3.906 = 3 906/1000 = 3906/1000=1953/500

INFORMATION SHEET

C. The division method--The most commonly used method; therefore it is the method we will use.

Example: 3/4 = n

$$\begin{array}{r} .75 \\ 4\,\overline{)\,3.00} \\ \underline{288} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

thus

3/4 = .75

II. Rule for multiplying decimal fractions by powers of ten--Move the decimal point to the left by the number of places there are zeroes in the denominator.

III. Metric units and definitions

- A. Meter--The basic unit of length in the metric system
- B. Decimeter--One tenth of a meter in length
- C. Centimeter--One hundredth of a meter in length
- D. Millimeter--One thousandth of a meter in length
- E. Dekameter--Ten times a meter in length
- F. Hectometer--One hundred meters in length
- G. Kilometer--One thousand meters in length

IV. Distances can be determined by using a metric measurer

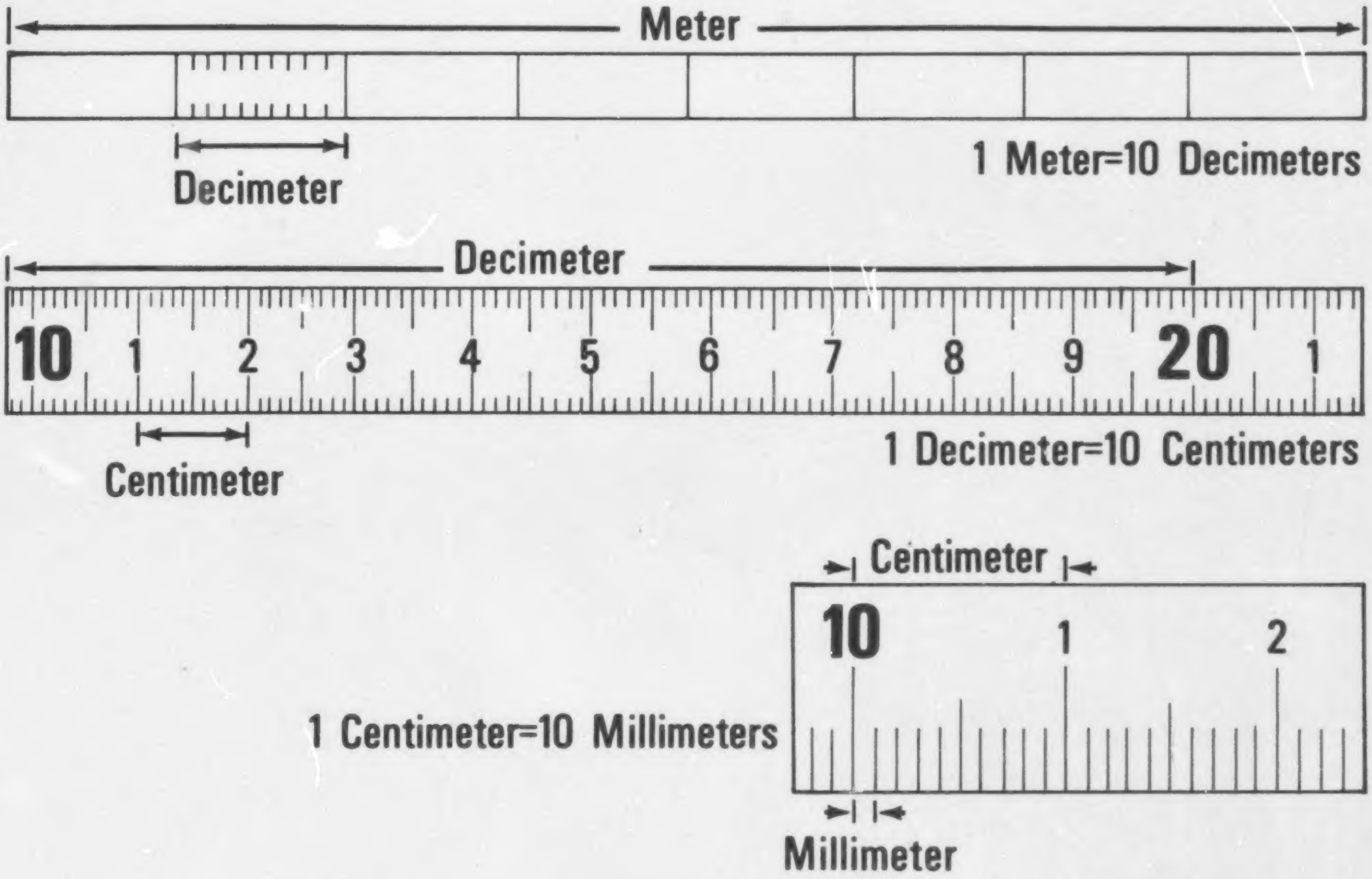
V. Conversion of metric units to equivalent smaller or larger units (Transparency 1)

(NOTE: Metric units are based on the number 10.)

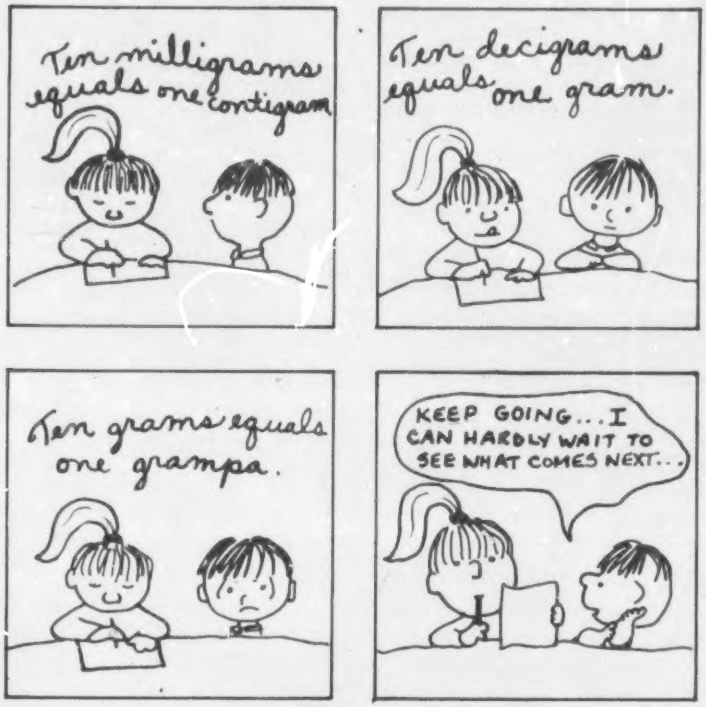
For example:

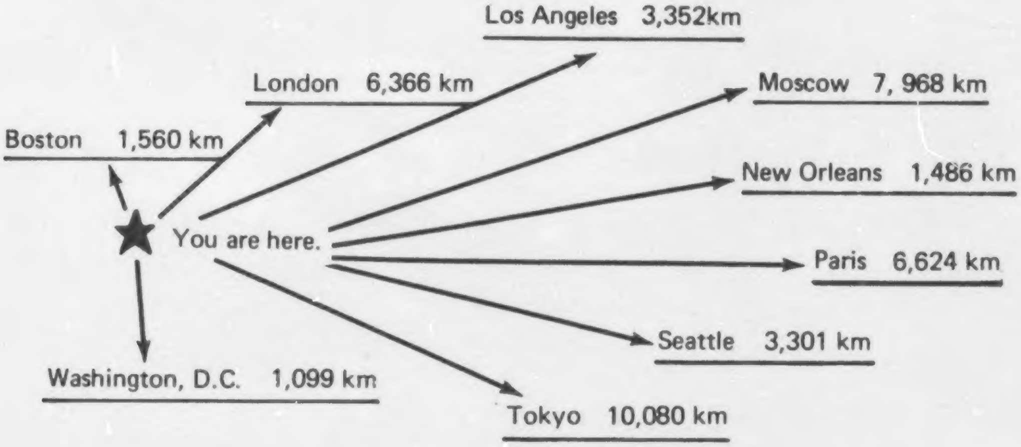
There are 10 millimeters in one centimeter.	10mm = 1cm
There are 10 centimeters in one decimeter.	10cm = 1dm
There are 10 decimeters in one meter.	10dm = 1m
There are 10 meters in one dekameter.	10m = 1dkm
There are 10 dekameters in one hectometer.	10dkm = 1hm
There are 10 hectometers in one kilometer.	10hm = 1km

Metric Measure


Meter
Decimeter
1 Meter=10 Decimeters
Decimeter
10
1
2
3
4
5
6
7
8
9
20
1
Centimeter
1 Decimeter=10 Centimeters
Centimeter
10
1
2
1 Centimeter=10 Millimeters
Millimeter

BULLETIN BOARD IDEAS


Ten milligrams equals one centigram
Ten decigrams equals one gram.
Ten grams equals one grampa.
KEEP GOING... I CAN HARDLY WAIT TO SEE WHAT COMES NEXT...



Los Angeles 3,352km

London 6,366 km

Moscow 7, 968 km

Boston 1,560 km

New Orleans 1,486 km

You are here.

Paris 6,624 km

Seattle 3,301 km

Washington, D.C. 1,099 km

Tokyo 10,080 km

WHERE ARE YOU?

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

ASSIGNMENT SHEET #1--CONVERT COMMON FRACTIONS TO DECIMAL FRACTIONS

Convert the following common fractions to decimal fractions by using the division method.

1. 1/2 __________
2. 3/2 __________
3. 3/8 __________
4. 9/4 __________
5. 4/5 __________
6. 3/20 __________
7. 3/75 __________
8. 6/50 __________
9. 1/25 __________
10. 1/4 __________

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

ASSIGNMENT SHEET #2--APPLY THE RULE FOR MULTIPLYING DECIMAL FRACTIONS BY POWERS OF TEN

Multiplying a decimal fraction by a fraction with a denominator of a power of ten moves the decimal point to the left the number of places there are zeroes in the denominator.

Study the following groups of numbers and the way each group is solved.

10 x .6 = 10 x 6/10 = 60/10 = 6

10 x .06 = 10 x 6/100 - 60/100 = .6

10 x .006 = 10 x 6/1000 =60/1000=.06

100 x .6 = 100 x 6/10 = 600/10 = 60/1 = 60

100 x .06 = 100 x 6/100 = 600/100 = 6/1 = 6

100 x .006 = 100 x 6/1000 = 600/1000 = 6/10 = .6

100 x .0006 = 1000 x 600/10000 = 6/100 = .06

1/10 x 6 = 6/10 = .6

1/10 x .6 = 1/10 x 6/10 = 6/100 = .06

1/10 x .06 - 1/10 x 6/100 = 6/1000 = .006

1/100 x 6 = 6/100 = .06

1/100 x .6 = 1/100 x 6/10 = 6/1000 = .006

1/100 x .06 = 1/100 x 6/100 = 6/10000 = .0006

Using the rule for multiplying a decimal fraction with a denominator of power of ten, solve the following problems.

1. 10 x .478 ________
2. 100 x 4.78 ________
3. 1/10 x 4.78 ________
4. 1/100 x 4.78 ________

ASSIGNMENT SHEET #2

5. 1000 x .478 ____________

6. 100 x 4.978 ____________

7. 10 x 47.8 ____________

8. 1/10 x 4.078 ____________

9. 10 x .478 ____________

10. 1/100 x .0478 ____________

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

ASSIGNMENT SHEET #3--DETERMINE DISTANCES USING THE METRIC SYSTEM OF MEASURING

"A Silly Millimeter Longer"

Many of you have already been in contact with the metric system if not in your science classes then on an old T.V. commercal that blurted out "just a silly millimeter longer." If you watch international track meets, such as in the Olympics, you have probably noticed that the distances are given in meters, not in yards. At a soccer game, the field is 100 meters in length, not 100 yards.

By 1983 Americans will no longer be using the English system of measurements. We will no longer be talking about every day quantities in "good old" inches, feet, miles, acres, pints, quarts, gallons, ounces, pounds, and tons. But like the rest of the major nations in the world, Americans will be using meters, liters, grams, centimeters and kilometers.

In the metric system

milli - means $\frac{1}{1000}$ or .001

Centi - means $\frac{1}{100}$ or .01

Deci - means $\frac{1}{10}$ or .1

Deka - means 10

Hecto - means 100

Kilo - means 1000

A kilometer (km) is 1000 meters or about the distance of 6 city blocks. The kilometer is used to measure long distances. The distance between towns in Europe is measured in kilometers not in miles. To compare the lengths of the mile and the kilometer, the kilometer is about 2/3 the length of a mile.

A hectometer (hm) is 100 meters or a distance a little longer than a football field.

A dekameter (dkm) is 10 meters in length.

A meter (m) is the basic unit of distance in the metric system and is just a little over 3 inches longer than a yard.

ASSIGNMENT SHEET #3

A decimeter (dm) is 1/10 of a meter and is probably just about the width of your palm.

A centimeter (cm) is 1/100 of a meter or a distance just about the width of your little finger.

A millimeter is 1/1000 of a meter or about the thickness of a dime.

Figure 1 shows part of a meter stick. The distance between A and AA is one centimeter. The distance between X and Y is also one centimeter. Notice that each centimeter is divided into ten parts. Each of these parts is called a millimeter. Therefore, a millimeter is 1/10 of a centimeter (or 1mm=1/10 cm or 1mm=.1cm).

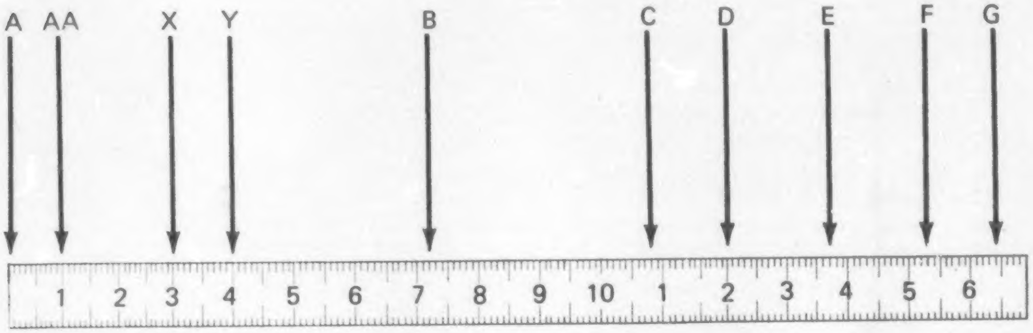


Figure 1

Now that you know the metric units for length, let's do some measuring. Use the scale in Figure 1. What is the distance between A and B in centimeters?

You may have had trouble making your reading because arrow B falls between the 7 and 8 centimeter mark. Notice that there are 10 millimeter marks between the 7 and the 8. The arrow is 2 millimeters beyond the 7 mark. This means that it is 0.2 (two tenths) of the way to the 8. This makes the reading 7.2 (seven and two tenths) centimeters.

What is the distance in centimeters between A and C in centimeters? This measurement is more difficult to make because the arrow C doesn't point right at a line. You could read it as 10.7 or 10.8. The better choice is 10.8 because the arrow is closer to this mark.

ASSIGNMENT SHEET #3

What is the distance between A and D? This measurement may seem the easiest of all. The arrow points directly to the 12 mark; therefore, this makes the distance 12 centimeters.

Find the distances between each of the following sets of points:

1. A and X ___________
2. A and E ___________
3. A and F ___________
4. A and G ___________
5. If you have meter sticks available for use, you can set up an activity to measure various objects in your room, including yourself.

Your Name___________________________

Your Partner's Name___________________

	m	dm	cm	mm
Your Height				
Partner's Height				
Your Armspan				
Partner's Armspan				
Your Handspan				
Partner's Handspan				
Width of desk top				
Length of desk top				
Width of room				
Width of pencil				
Width of small finger				
Length of this sheet				
Width of this sheet				
Length of math book				
Width of math book				
Two other objects in the room				

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

ASSIGNMENT SHEET #4--CONVERT METRIC UNITS TO EQUIVALENT LARGER OR SMALLER UNITS

Example 1: How many centimeters are there in a meter?

10cm = 1 dm
and 10 dm = 1m;
therefore, there are 10 x 10 or 10^2 or 100 cm in one meter.
Answer: 100 cm = 1m

Example 2: How many millimeters are there in one hectometer?
Another way to ask this question is with the equation:
1hm = __________mm
If we think about the metric units
10 mm = 1 cm
10 cm = 1 dm
10 dm = 1 m
10 m = 1 dkm
10 dkm = 1 hm
or 1 hm = 10 x 10 x 10 x 10 x 10 mm or 10^5 mm or 100,000 mm.
Answer: 1 hm = 100,000 mm

Example 3: How many centimeters are there in 5 hectometers?
Or 5 hm = __________cm.
Think about the metric units.
10 cm = 1 dm
10 dm = 1 m
10 m = 1 dkm
10 dkm = 1 hm
or 1 hm = 10^4 cm or 10,000 cm.
So 5 hm = 5 x 10^4 cm or 50,000 cm.

Now work a few problems on your own to see how you are doing. Answer these using power of ten notation and decimal notation.

1. 1 km = _____m
2. 1 dkm = _____dm
3. 1 km = _____cm
4. 4 km = _____cm
5. 1.5 km = _____mm

ASSIGNMENT SHEET #4

You have probably noticed that we have only been converting from larger units to smaller units. There is a slightly different way to convert from smaller units to larger units. First, lets set up a table much like the one before. If 1 cm = 10 mm, then

One millimeter is 1/10 of a centimeter- - - 1 mm = 1/10 cm
One centimeter is 1/10 of a decimeter - - - 1 cm = 1/10 dm
One decimeter is 1/10 of a meter- - - - - - 1 dm = 1/10 m
One meter is 1/10 of a dekameter- - - - - - 1 m = 1/10 dkm
One dekameter is 1/10 of a hectometer - - - 1 dkm = 1/10 hm
One hectometer is 1/10 of a kilometer - - - 1 hm = 1/10 km

Example 4: What part of a meter is a millimeter?

1 mm = __________m
1 mm = 1/10 cm
1 cm = 1/10 dm
1 dm = 1/10 m
Answer: 1 mm = (1/10 x 1/10 x 1/10) m = $1/10^3$ = 1/1000m = .001m

Example 5: What part of a hectometer is a centimeter?

Or 1 cm = _____hm
1 cm = 1/10 dm
1 dm = 1/10 m
1 m = 1/10 dkm
1 dkm = 1/10 hm
Answer: 1 cm = (1/10 x 1/10 x 1/10 x 1/10) hm = $1/10^4$ hm =
1/10,000 hm = .0001 hm.

Example 6: 8 mm = __________km.

1 mm = 1/10 cm
1 cm = 1/10 dm
1 dm = 1/10 m
1 m = 1/10 dkm
1 dkm = 1/10 hm
1 hm = 1/10 km
mm = (1/10 x 1/10 x 1/10 x 1/10 x 1/10 x 1/10) km = $1/10^6$ km =
1/1,000,000=.000001 km
8mm = 8 x $1/10^6$ km = 8 x .000001 km = .000008 km (Answer)

Try a few of this type of problems on your own.

6. 1 mm = __________hm

7. 1 dkm = __________km

8. 7 dm = __________dkm

9. 12 cm = __________hm

10. 1.56 dm = __________hm

ASSIGNMENT SHEET #4

These powers of ten are really easy to work with. Once you get used to the units, there is an even easier way to convert from one metric unit to another. You have probably noticed that when you change from one metric unit to another it becomes iust a matter of moving the decimal point. But in which direction and how far are two problems you need to get very clear in your mind.

In Example 3, 5 hm = 5 x 10^4 cm = 50,000 cm, the decimal point was moved in which direction and how far? It was moved 4 places to the right or 5 hm = 50000 cm.

Example 6, 8 mm = .000008 km, the decimal was moved in which direction and how far? It was moved 6 places to the left or 8 mm = .000008 km.

Why does the decimal point move to the right when you convert from a larger unit to a smaller one? And why does the decimal point move to the left when you convert from a smaller unit to a larger one? Cound you think of an easier method to convert metric units than the one explained in the previous sections of this information sheet?

Here is one easier method. After you have thought it through, try to explain why it works.

Think of the units in the metric system as corresponding to place values in base ten numbers.

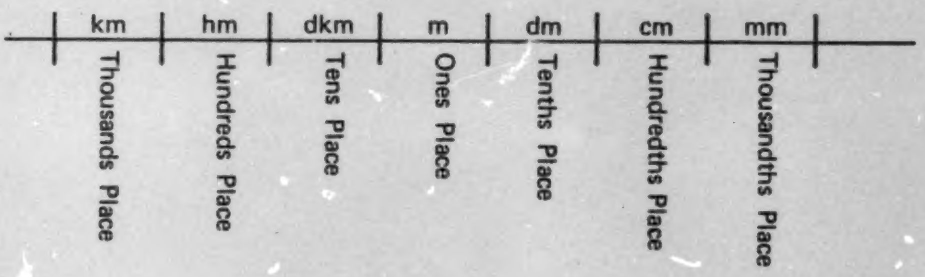


Figure 3

Converting from one unit to another becomes just a matter of moving a decimal point. Let's try the problem, 1 km = __________ dm.

To move from km to dm in Figure 3 is a move four spaces to the right. For the answer you only have to move the decimal point four places to the right. Therefore, 1 km = 10000 dm.

Another problem 2cm = __________ km. To move from cm to km in Figure 3 is a move five spaces to the left. Therefore, 2 cm = .00002 km.

ASSIGNMENT SHEET #4

Carefully study the following examples:

Example 7: 2.5 km = __________dm

2.5 km = 25000 dm

Example 8: 3.8 mm = __________dm

3.8 = .038 dm

This is a very easy method of converting to be used only if you understand why it works. Work the following problems using this method.

11. 3 cm = __________mm
12. 400 mm = __________cm
13. 1 dm = __________cm
14. 1 hm = __________mm
15. 1 dm = __________mm
16. 1 hm = __________cm
17. 4 km = __________mm
18. 12 dkm = __________m
19. 42000 m = __________km
20. 25 km = __________m
21. 7 hm = __________m
22. 7.3 km = __________dm
23. 2 m = __________km
24. 5 hm = __________dkm
25. 15 dkm = __________hm
26. 15 dkm = __________km
27. 33 m = __________ km
28. 35 hm = __________km

ASSIGNMENT SHEET #4

29. 20 km = __________hm

30. 31 km = __________dkm

31. 12 dkm = __________dm

32. 5 dm = __________mm

33. 7 m = __________cm

34. 25 cm = __________dm

35. 8 hm = __________dkm

36. 14 cm = __________m

37. 350 m = __________mm

38. 200 dm = __________m

39. 1000 dm = __________dkm

40. 600 km = __________hm

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. .5
2. 1.5
3. 3.75
4. 2.25
5. .8
6. .15
7. .04
8. .12
9. .04
10. .25

Assignment Sheet #2

1. 4.78
2. 478
3. .478
4. .0478
5. 478
6. 497.8
7. 478
8. .4078
9. 4.78
10. .000478

Assignment Sheet #3

1. 3 cm
2. 13.7 cm
3. 15.3 cm
4. 16.4 cm
5. Answers will vary--Evaluated to the satisfaction of the instructor

Assignment Sheet #4

1. 1 km = 10^3 m = 1000 m
2. 1 dkm = 10^2 dm = 100 dm
3. 1 km = 10^5 cm = 100,000 cm
4. 4 km = 4 x 10^5 cm = 400,000 cm
5. 1.5 km = 1.5 x 10^6 mm = 1,500,000 mm
6. 1 mm = $1/10^5$ hm = .00001 hm
7. 1 dkm = $1/10^2$ km = .01 km
8. 7 dm = 7 x $1/10^2$ dkm = .07 dkm
9. 12 cm = 12 x $1/10^4$ hm = .0012 hm
10. 1.56 dm = 1.56 x $1/10^3$ hm = .00156 hm
11. 3 cm = 30mm
12. 400 mm = 40 cm
13. 1 dm = 10 cm
14. 1 hm = 100,000 mm
15. 1 dm = 100 mm
16. 1 hm = 10,000 cm
17. 4 km = 4,000,000 mm
18. 12 dkm = 120 m
19. 42000 m = 42 km
20. 25 km = 25,000 m

21. 7 hm = 700 m
22. 7.3 km = 73,000 dm
23. 2 m = .002 km
24. 5 hm = 50 dkm
25. 15 dkm = 1.5 hm
26. 15 dkm = .15 km
27. 33 m = .033 km
28. 35 hm = 3.5 km
29. 20 km = 200 hm
30. 31 km = 3100 dkm
31. 12 dkm = 1200 dm
32. 5 dm = 500 mm
33. 7 m = 700 cm
34. 25 cm = 2.5 dm
35. 8 hm = 80 dkm
36. 14 cm = .14 m
37. 350 m = 350,000 m
38. 200 dm = 20 m
39. 1000 dm = 10 dkm
40. 600 km = 6000 hm

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

JOB SHEET #1--CONSTRUCT A MEASURING DEVICE

Indirect measurement is often studied in geometry courses. The purpose of this job sheet is to outline the construction and use of a device to measure the heights of objects. The device will enable you to actually make indirect measurements and help you to appreciate the fact that there are applications of the mathematics you study in class.

I. Tools and materials needed

   A. A piece of cardboard, poster board, or comparable material

   B. Stapler

   C. Scissors

   D. Holepunchers

   E. Marking pen

II. Procedures

   A. Using the dimensions indicated in Figure 1, draw the outlines of the frame and the slide on a piece of cardboard. (Figure 1 is not drawn to scale, but it indicates the shape of the device.)

   B. Cut out the two parts

   C. Crease the cardboard along the lines marked FOLD in Figure 1

   D. Cut out the shaded rectangular area; cut out the circular region in the eyepiece

   E. Mark units of 4 centimeters on the slide and label as shown in Figure 1

   F. Fold the cutout frame so that A falls on A', and B on B', and C on C'

   G. Fold the eyepiece so that it is perpendicular to the rest of the frame (Figure 2)

   H. Fold the two rectangular regions together so that they are perpendicular to the rest of the frame and the cutout rectangular region is facing the eyepiece

   I. Staple the two sides together at A, B, and C

   J. Slip the slide into the frame so that the numbered intervals are visible through the cutout rectangular region and the slide can be moved up and down (Figure 2)

   (NOTE: The slide may have to be trimmed slightly to fit into the frame.)

JOB SHEET #1

III. Diagram of procedure

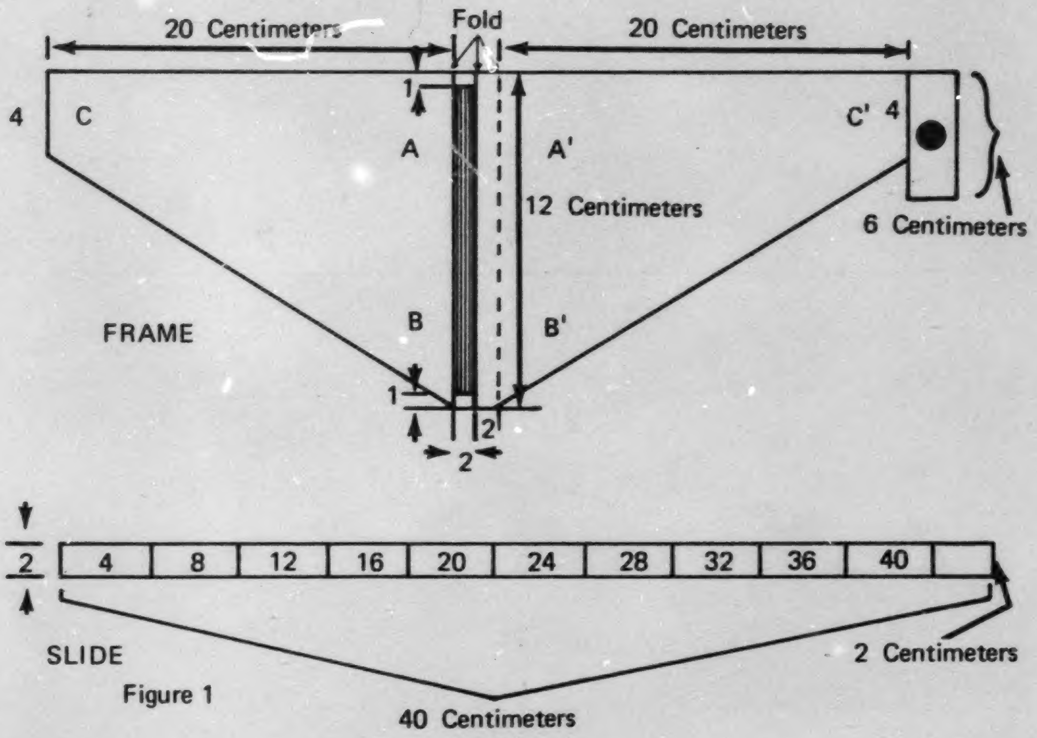

20 Centimeters
Fold
20 Centimeters
4
C
1
A
A'
C'
4
12 Centimeters
6 Centimeters
FRAME
B
B'
1
2
2
2
4
8
12
16
20
24
28
32
36
40
SLIDE
2 Centimeters
40 Centimeters

Figure 1

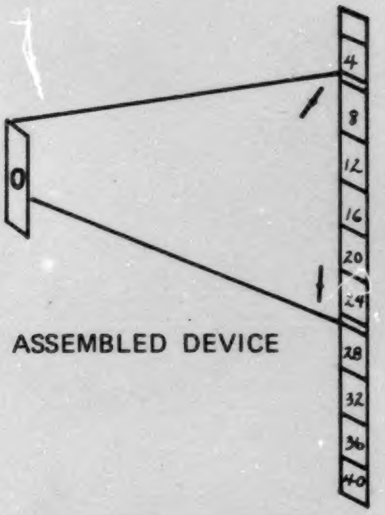

0
4
8
12
16
20
24
28
32
36
40
ASSEMBLED DEVICE

Figure 2

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

JOB SHEET #2–INDIRECT MEASUREMENTS

I. Tools and materials needed

- A. A measuring device such as the one constructed in Job Sheet #1 of this unit
- B. A tall object to be measured

  (NOTE: We will use a tree for our example.)

II. Procedures for measuring the height of an object

- A. View the object through the eyepiece being careful to keep the slide vertical when a height is being measured
- B. Adjust the slide so that the top of the object is aligned with the top of the slide (Figure 1)
- C. Holding the device steady, determine the number n on the scale that is aligned with the base of the tree (Figure 1)
- D. Measure the distance d, in feet, to the base of the object that is being measured (Figure 1)
- E. Using similarity of triangles, compute the height x of the object from the equation $x/d = n/10$. (Figure 1) (Notice that if one stands 100 feet from the base of the object, then x can be read off the slide in units of 10 feet.)

III. Diagram of procedure

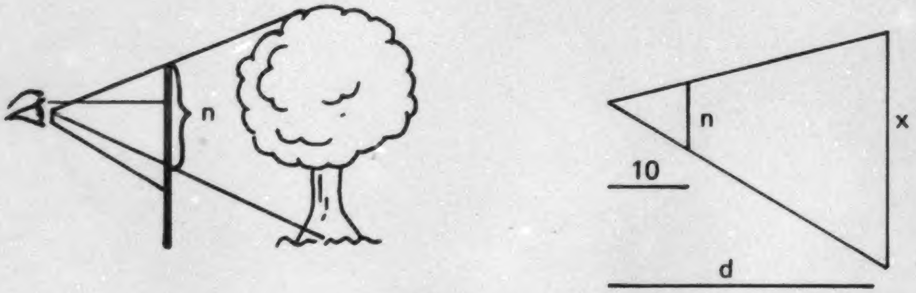


Figure 1

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

TEST

1. Convert the following common fractions to decimal fractions. Round answers to three decimal places.

   a. 2/5

   b. 5/6

   c. 9/3

   d. 6/7

   e. 2/3

2. Apply the rule for multiplying decimal fractions by powers of ten to solve the following.

   a. 1/10 x 3.75

   b. 1/100 x .375

   c. 1/1000 x 37.5

   d. 100 x .375

   e. 10 x 3.75

   f. 1/1000 x 4.32

   g. 1/10 x 4.32

   h. 1000 x .432

   i. 10 x 43.2

   j. 1/100 x .432

3. Match the metric units on the right to the correct definitions.

______a. Basic unit of length in the metric system

______b. One tenth of a meter

______c. One hundredth of a meter

______d. One thousandth of a meter

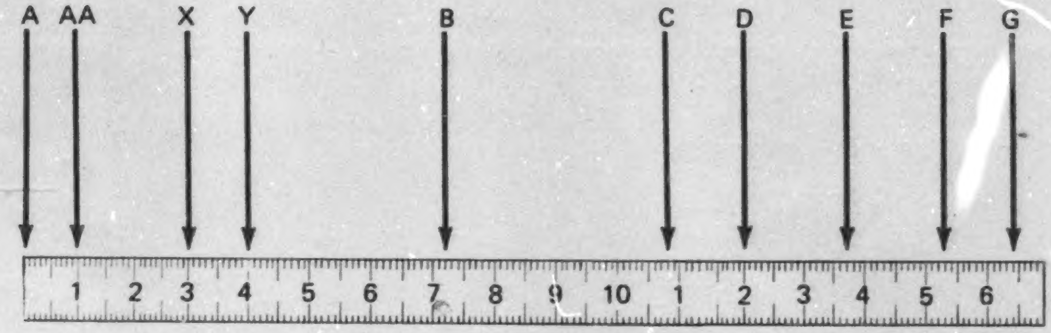
______e. Ten meters

______f. One hundred meters

______g. One thousand meters

1. Centimeter
2. Dekameter
3. Decimeter
4. Hectometer
5. Kilometer
6. Meter
7. Millimeter

4. Determine the distances between the points in centimeters on the scale shown below.



a. A and C _____

b. A and B _____

c. A and X _____

d. A and F _____

e. A and G _____

5. Convert the following metric units to the larger or smaller units indicated.

a. 1 dm = _____cm

b. 1 dm = _____mm

c. 4 km = _____mm

d. 25 km = _____m

e. 7.3 km = _____dm

f. 15 dkm = _____hm

g. 33 mm = _____km

h. 31 km = _____dkm

i. 5 dm = _____mm

j. 8 hm = _____dkm

6. Demonstrate the ability to manufacture and use a metric measuring device.

(NOTE: If this activity has not been completed prior to the test, ask your instructor when it should be completed.)

MATHEMATICS IN MANUFACTURING
METRIC MEASURE

ANSWERS TO TEST

1. a. .4
   b. .833
   c. 3
   d. .857
   e. .667
2. a. .375
   b. .00375
   c. .0375
   d. 37.5
   e. 37.5
   f. .00432
   g. .432
   h. 432
   i. 432
   j. .00432
3. a. 6
   b. 3
   c. 1
   d. 7
   e. 2
   f. 4
   g. 5
4. a. 10.8
   b. 7.2
   c. 3

d. 15.3

e. 16.4

5. a. 10

b. 10

c. 4,000,000

d. 25,000

e. 73,000

f. 1,500

g. .000033

h. 3,100

i. 500

j. 80

6. Evaluated to the satisfaction of the instructor.

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to apply the rules for determining ratio and proportion and for converting fractions and decimals to equivalent percents. He should be able to identify the jobs in the health cluster which primarily use math skills. He should be able to calculate the projected need for hospital beds for the local area five years from now. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match ten terms associated with hospital data to their definitions.
2. Identify four jobs in the health cluster which primarily use math skills.
3. Apply the rules for expressing ratio.
4. Apply the rules for determining proportion.
5. Convert percent notations to fractions and to decimals.
6. Convert decimals and fractions to percent notations.
7. Determine the need for hospital beds in the local community five years from now.

This unit was written by Nancy Amos in a class at Central State University under the direction of Dr. Richard Mitchell, Professor of Education.

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

SUGGESTED ACTIVITIES

I. Instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and assignment sheets.

   C. Make transparencies and bulletin board suggestions.

   D. Discuss terminal and specific objectives.

   E. Discuss information and assignment sheets.

   F. Assist students through the different steps in each assignment sheet.

   G. Contact the Oklahoma Employment Securities Commission to get the projected population for your area five years from now.

   H. Contact Area Wide Health Planning to get the number of patient days in the area last year.

   I. Give test.

II. Student:

   A. Read objective sheet.

   B. Study information sheet.

   C. Complete the operations in each assignment sheet.

   D. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

   A. Objectives

   B. Information sheet

   C. Transparency masters

      1. TM 1–Trends in Hospital Utilization

      2. TM 2–Data on Individual Hospital Activity

3. TM 3–Population Information

(NOTE: Transparencies are to be used with Assignment Sheet #5.)

D. Bulletin board suggestions

E. Assignment sheets

1. Assignment Sheet #1–Expressing Ratios
2. Assignment Sheet #2–Using Proportions
3. Assignment Sheet #3–Percent Notation
4. Assignment Sheet #4–Percent Notation
5. Assignment Sheet #5–Calculate the Need for Hospital Beds

F. Answers to assignment sheets

G. Test

H. Answers to test

II. References

A. American Hospital Association. *Hospital Statistics, 1972.*

B. Beyer, R. *Administrative Management,* "Stretching Your Clerical Dollars," Vol. 25:24. February, 1964.

*C. Denholm and Blank. *Mathematics: Structure and Skills.* Chicago, Illinois: Science Research Associates, Inc., 1968.

*D. Dolciani, et. al. *Modern School Math.* New York: Houghton-Mifflin Company, 1967.

*E. Eicholz, O'Daffer, Brumfill, Shanks. *Basic Modern Mathematics.* Menlo Park, California: Addison-Wesley, 1969.

F. McSwain, Brown, Gundlach, Cooke. *Mathematics.* River Forest, Illinois: Laidlaw Brothers, 1963.

G. Oklahoma Council for Health Careers. "Profiles of Health Careers." 1973.

H. "What Do You Do? Formula for Measuring Productivity," *Medical Record News,* Vol. 34:216. October, 1971.

I. Williams, N. *The Management of Hospital Employee Productivity: An Introductory Handbook,* American Hospital Association, 1973.

*These books are published in a grade sequence, e.g. 7th and 8th.

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

INFORMATION SHEET

I. Terms and definitions

   A. Inpatient--A person who remains in the hospital for treatment, rather than being treated in emergency and sent home

   B. Census day--The twenty-four hour period, usually midnight to midnight, when a count is taken of the number of inpatients

   C. Discharge--When a patient is released from the hospital

   D. Patient days--Unit of measure meaning one patient staying in a room for one census day

   E. Occupancy rate--Percentage of occupancy consisting of the ratio of the ACTUAL number of patient days to the MAXIMUM POSSIBLE number of patient days during a given time

   F. Use rate--Ratio of patient days of a given year to the population of that area in that same year

   G. Average daily census--Average number of inpatients maintained in the hospital each day for a given period of time

   H. Average length of stay--Average number of days of care given to each inpatient discharge during a given period

   I. Patient services--All the care given to a patient while he is in the hospital

   J. Per diem cost--Total cost to the hospital of providing one day of care for one patient

II. Jobs in the health cluster which primarily use math skills

   A. Hospital administrator--Chief executive responsible for all phases of the hospital's activities

   B. Purchasing agent--Directs the purchase and issuance of materials, supplies, equipment, and services for hospital use

   C. Hospital engineer--Responsible for the repair, maintenance, and upkeep of equipment, buildings, and grounds including the lighting, heating, plumbing, and elevator service

INFORMATION SHEET

D. Accountant--In charge of paying the bills of the hospital and issuing bills to the patients

(NOTE: In a large hospital, he may use a computer.)

E. Medical secretary--Maintains patients' records, fills out insurance forms, handles correspondence, and other simple duties in a clinic or laboratory

F. Biostatistician--Analyzes and prepares records, calculations, and reports of statistical data; prepares graphs and charts; and participates in research projects

III. Rules for expressing ratio

A. Ways to write "the ratio of a to b"

1. a : b

2. a / b

3. a to b

B. BOTH numbers must be expressed in the same unit of measure, e.g. inches to inches, pounds to pounds, years to years

C. When numbers are not in the same unit, one number must be converted so that it is like the other

D. Conversion chart for Assignment Sheet #1

1. 3 tsp. = 1 tbs.
2. 1 c. = 8 oz.
3. 16 oz. = 1 lb.
4. 1 oz. = 2 tbs.
5. 2 c. = 1 pt.
6. 2 pts. = 1 qt.
7. 4 qts. = 1 gal.
8. 1 ft. (') = 12 in. (")
9. 3' = 1 yd.
10. 1760 yds. = 1 mi.
11. 5280' = 1 mi.
12. 0.04" = 1 mm.
13. 1 cm. = 10 mm.
14. 0.39 in. = 1 cm.
15. 1 in. = 2.54 cm.
16. 39.37 in. = 1 meter
17. 0.62 mi. = 1 km.
18. 1 ft. = 0.30 meter
19. 1 yd. = 0.91 meter
20. 1 mi. = 1.61 km.

INFORMATION SHEET

IV. Rules for finding proportion

  A. Cross multiply the two fractions

  B. Divide both sides by the number multiplied times the variable

V. Changing percent notations to fractions and decimals

  A. To change percent notation to a fraction, rewrite the number over 100, then reduce to lowest terms

  B. To change percent notation to decimal, divide the given number by 100

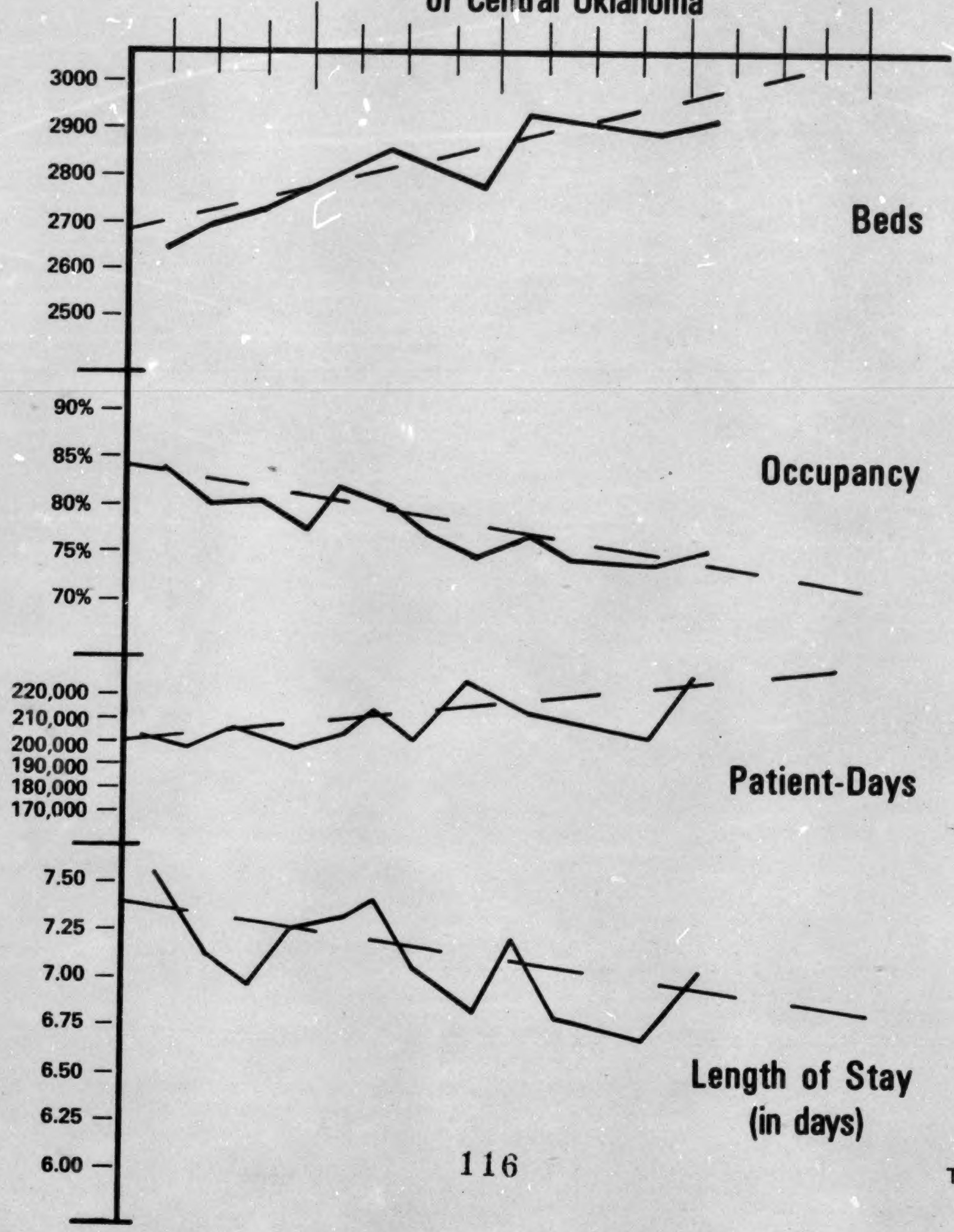
VI. Changing decimals and fractions to percent notations

  A. To change decimal notation to percent, multiply the given number by 100

  B. To change a fraction to percent, change to a decimal, then multiply by 100

Trends in Hospital Utilization

Areawide Health Planning Organization of Central Oklahoma



TM 1

Data on Individual Hospital Activity

(FIRST QUARTER) (90 DAYS)

Hospital	Av. No. Beds	Av. Daily Census	Occ. Rate	Patient Days	Discharge & Deaths	Av. Stay
BAPTIST MED. CENT.	376	338.1	89.9%	30,428	3,784	8.0
DEACONESS	177	165.1	93.3	14,856	2,451	6.1
DRS. GENERAL	93	59.6	64.1	5,362	705	7.6
EDMOND MEM.	35	26.9	76.8	2,418	428	5.6
HILLCREST OST.	108	90.3	83.6	8,128	1,154	7.0
LOGAN CO. MEM	44	24.7	56.1	2,220	274	8.1
MERCY	181	145.8	80.6	13,145	1,967	6.7
MIDWEST CITY	178	126.5	71.1	11,390	1,920	5.9
MISSION HILL	78	44.6	57.2	4,013	641	6.3
MOORE MUNIC.	50	32.8	65.6	2,950	588	5.0
NORMAN MUNIC.	203	151.0	74.4	14,398	2,475	5.8
PARKVIEW	44	29.2	66.3	2,624	365	7.2
PRESBYTERIAN	195	152.2	78.1	13,712	2,356	5.8
ST. ANTHONY	712	495.6	69.5	44,583	5,784	7.6
S. COMMUNITY	197	187.6	95.2	16,882	2,786	6.1
UNIVERSITY	400	262.8	65.7	23,655	2,938	8.1
TOTAL	3,071	2,332.8		210,764	30,616	7.0

Population Information

Last Year (1972)	Average Number of Beds in Your Area 3,071	Population of Your Area 684,520	Total Patient Days 960,328
5 Years From Now	Projected Need for Hospital Beds ?	Projected Population 728,500	

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

BULLETIN BOARD SUGGESTIONS

I. Any hospital will give you enough of the forms they use to cover a bulletin board

  A. Registration forms

  B. Bills

  C. Laboratory test forms

  D. Computer printouts of hospital statistics

II. Cut out pictures of people who work in health fields and the equipment they use. Health magazines and medical journals have many of these pictures.

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ASSIGNMENT SHEET #1--EXPRESSING RATIOS

A ratio is an ORDERED pair of numbers

Example: On the staff of a local hospital there are 88 nurses and 16 doctors. The ratio of nurses to doctors is 88 to 16. The ratio of doctors to nurses is 16 to 88.

Express the following ratios as fractions in the lowest terms. Be sure that the measurement units are the same.

	a.		b.	
1.	3 to 7	______	$2 to $8	______
2.	13' to 16'	______	10 to 8	______
3.	4" to 8"	______	10 hrs. to 6 hrs.	______
4.	9 to 21	______	12.5 to 5.7	______
5.	6 oz. to 12 tbs.	______	30 c. to 3 pts.	______
6.	2 c. to 2 qts.	______	3 mi. to 60 yds.	______
7.	1 gal. to 16 c.	______	10 in. to 10 cm.	______

Express the following ratios as a:b. Be sure that measurement units are the same.

	a.		b.	
8.	7' to 24"	______	2 lbs. to 8 oz.	______
9.	5' to 4"	______	18 hrs. to 2 da.	______
10.	$4 to 80¢	______	1 1/2 yds. to 9 in.	______
11.	1/2 ft. to 5/8 ft.	______	7.5" to 2.5"	______
12.	3' to 3 yds.	______	11 cm. to 1 mm.	______
13.	3 tbs. to 3 tsp.	______	12 km. to 12 mi.	______
14.	3 qts. to 18 pts.	______	4 yds. to 6 ft.	______

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ASSIGNMENT SHEET #2--USING PROPORTIONS

Proportion is a statement of equality between two ratios.

Example: The x-ray machine takes a 3-inch by 4-inch x-ray. The viewing screen is 9 inches wide and is the same proportion as the small x-ray. When the x-ray is blown up, how long will it be?

Proportion: $$\frac{3''\text{ (original width)}}{4''\text{ (original length)}} = \frac{9''\text{ (width blown up)}}{n\text{ (length blown up)}}$$

Solution:
$$\begin{aligned} 3 \times n &= 9 \times 4 \\ 3n &= 36 \\ \frac{3n}{3} &= \frac{36}{3} \\ n &= 12 \end{aligned}$$

Find the value of n in each of the following proportions.

1. $\frac{2}{7} = \frac{n}{56}$ a. $\frac{n}{6} = \frac{16}{96}$ b.
2. $\frac{n}{9} = \frac{20}{36}$ $\frac{84}{36} = \frac{n}{3}$
3. $\frac{4}{3} = \frac{n}{90}$ $\frac{n}{8.8} = \frac{3}{8}$
4. $\frac{8}{9} = \frac{n}{63}$ $\frac{6}{7} = \frac{n}{3.5}$
5. $\frac{n}{65} = \frac{7}{5}$ $\frac{11}{1.7} = \frac{n}{17}$
6. $\frac{15}{7} = \frac{n}{28}$ $\frac{n}{4} = \frac{19}{76}$
7. $\frac{7}{11} = \frac{n}{66}$ $\frac{3}{n} = \frac{57}{95}$
8. $\frac{5}{n} = \frac{45}{81}$ $\frac{3}{7} = \frac{78}{n}$
9. $\frac{n}{3} = \frac{.15}{.45}$ $\frac{45}{75} = \frac{n}{2.5}$
10. $\frac{n}{2} = \frac{.6}{.48}$ $\frac{n}{3.6} = \frac{1}{3}$

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ASSIGNMENT SHEET #3--PERCENT NOTATION

Percent denotes any fraction whose denominator is 100.

Example: If 68 out of 100 hospital employees are women, then what percentage of the employees are women?

Solution: $\frac{68}{100}$ = 68 percent = 68%

When changing from percent notation to fractions (or mixed number), rewrite the number as a fraction, then reduce to lowest terms. Examine carefully the following examples.

$$45\% = \frac{45}{100} = \frac{5 \times 9}{5 \times 20} = \frac{9}{20}$$

$$140\% = \frac{140}{100} = \frac{2 \times 70}{2 \times 50} = \frac{70}{50} \text{ or } 1\frac{20}{50} \text{ or } 1\frac{2}{5}$$

Express the following percents as fractions.

	a.		b.	
1.	38%	______	16%	______
2.	99%	______	18%	______
3.	4 1/2%	______	.5%	______
4.	48%	______	26%	______
5.	25%	______	3.95%	______
6.	77%	______	88%	______
7.	33.3%	______	.25%	______
8.	.7%	______	.05%	______
9.	6 1/2%	______	2 1/4%	______
10.	287%	______	600%	______

ASSIGNMENT SHEET #3

When changing from percent notation to decimal notation, divide the number by 100. Examine the following examples.

$$46\% = \frac{46}{100} \qquad 143\% = \frac{143}{100} \qquad 12\ 1/4\% = \frac{12.25}{100}$$

$$= 0.46 \qquad = 1.43 \qquad = 0.1225$$

Express the following percents as decimals.

	a.		b.	
11.	0.10%	______	301%	______
12.	150%	______	6.50%	______
13.	350%	______	15%	______
14.	11%	______	6.5%	______
15.	0.004%	______	1/4%	______
16.	176%	______	0.60%	______
17.	9.75%	______	0.001%	______
18.	125%	______	85%	______
19.	12%	______	0.20%	______
20.	1/16%	______	0.01%	______

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ASSIGNMENT SHEET #4--PERCENT NOTATION

When changing from decimal notation to percent notation, multiply the given number by 100. Examine carefully the following examples.

0.76 = 0.76 x 100	0.775 = 0.775 x 100	7.62 = 7.62 x 100
= 76%	= 77.5%	= 762%

Express the following decimals as percent.

	a.		b.	
1.	0.16	______	0.35	______
2.	0.66 2/3	______	0.03 1/3	______
3.	0.8	______	0.003	______
4.	0.004 3/4	______	0.0014	______
5.	1.25	______	1.4	______
6.	0.76	______	0.02	______
7.	0.87 1/2	______	0.5	______
8.	0.0015	______	0.0007	______
9.	0.0276	______	0.1324	______
10.	2.2	______	5.55	______

ASSIGNMENT SHEET #4

When changing from a fraction (or mixed number) to percent notation, change to a decimal, then multiply by 100. Examine the following examples carefully.

$$
\begin{aligned}
1\ 3/4 &= 1 + \frac{75}{100} \\
&= \frac{100}{100} + \frac{75}{100} \\
&= \frac{175}{100} = 1.75 \\
&= 1.75 \times 100 = 175\%
\end{aligned}
$$

$$
\begin{aligned}
\frac{1}{400} &= 1 \div 400 \\
&= 0.0025 \\
&= 0.0025 \times 100 \\
&= 0.25\%
\end{aligned}
$$

Express the following fractions (or mixed numbers) as percents.

	a.		b.	
11.	1/2	______	1/4	______
12.	1/3	______	1/6	______
13.	2/7	______	5/8	______
14.	9/8	______	8/8	______
15.	15/16	______	20/10	______
16.	1/7	______	1/8	______
17.	4/5	______	3/8	______
18.	2/3	______	22/44	______
19.	18/30	______	21/28	______
20.	11/22	______	7/6	______

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ASSIGNMENT SHEET #5--CALCULATE THE NEED FOR HOSPITAL BEDS

There are many ways math is used in various health careers. One way a hospital administrator or a health planner might use it would be in determining the need for new hospitals for the future. Look at the trend in hospital utilization in the given area (TM 1). It is necessary that we have enough hospital beds, but it is equally important not to have too many.

If there are too many hospitals, too many beds might stay vacant. Look at what happens if the hospitals have too many vacant beds. The number of patients in a hospital determines the per diem cost. That is, the cost to the patient would vary according to how "full" the hospitals are. Average per diem cost is calculated by taking the total cost of providing patient services for a given period of time and dividing it by the total patient days of care rendered during the same period. Actually, it is a ratio of total cost to total patient days. Look at the following examples.

Example A:

During the month of May, a hospital incurred a total cost of $895,900 in providing patient services. During the same period of time, the hospital rendered 10,540 patient days of care. The average per diem cost is computed:

$$\text{per diem cost} = \frac{\text{total cost of hospital}}{\text{total patient days}} = \frac{\$895{,}900}{10{,}540} = \$85$$

Example B:

If there had been more patient days for that same hospital, (if there had been more people in the hospital) the per diem would have been lower. For instance, if there had been 11,600 patient days, per diem cost would be calculated:

$$\text{per diem} = \frac{\$895{,}900}{11{,}600} = \$77.23$$

1. Let us calculate the need for hospital beds in your area five years from now. Look first at the current occupancy rate for the hospitals in your area (TM 2). This will tell what percentage of the time the hospitals are full. Occupancy rate is the ratio of total patient days to average number of beds in a hospital or area times the number of days in the time period.

$$\text{Occupancy rate} = \frac{\text{total patient days}}{\text{average number of beds X number of days in the time}}$$

$$= \frac{?}{?} =$$

ASSIGNMENT SHEET #5

The quotient is the average occupancy rate in your area. It can be seen from TM 2 that some hospitals have a high occupancy rate and some have a rather low occupancy rate.

2. Now we would like to figure the use rate of the area hospitals for last year (TM 3). Use rate is the ratio of the number of patient days of a given year to the population of that area in that year.

$$\text{use rate} = \frac{\text{number of patient days last year}}{\text{population of the area last year}} = \frac{?}{?} =$$

3. Then figure the average daily census. It is the ratio of the current use rate times the projected population for five years from now to the number of days in a year.

$$\text{average daily census} = \frac{\text{projected population X current rate}}{365}$$

$$= \underline{\hspace{6cm}} +$$

4. Next divide the average daily census by 85% to get the projected bed need for five years from now.

$$\frac{\text{Average daily census}}{.85} =$$

The quotient is the projected need for hospital beds.

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

(Use conversion chart to get equivalents. Other answers are possible in some cases.)

	a.	b.
1.	3/7	$1/4 or .25
2.	13/16'	5/4
3.	1/2"	5/3 = 1 2/3 hrs.
4.	3/7	12.5/5.7
5.	6/6 oz. = 1	5/1 c.
6.	1/4 c.	88/1 yd.
7.	16/16 c. = 1	10/25.4 in.
8.	7:2 ft.	4:1 oz.
9.	5:1/3 ft. or 15:1 in.	9:24 hrs.
10.	5:1¢	6:1"
11.	1/2 : 5/8'	3:1"
12.	1:3 yds.	110:1 mm.
13.	3:1 tbs.	7.44 : 12 mi.
14.	1:3 pts.	2:1 yds.

Assignment Sheet #2

	a.	b.
1.	16	1
2.	5	7
3.	120	3.3

4.	56	3
5.	91	110
6.	60	1
7.	42	5
8.	9	182
9.	1	1.5
10.	2.5	1.2

Assignment Sheet #3

	a.	b.
1.	19/50	4/25
2.	99/100	9/50
3.	.9/20	.1/20
4.	12/25	13/50
5.	1/4	.79/20
6.	77/100	22/25
7.	33.3/100	.01/4 or 1/400
8.	.7/100	.01/20 or 1/2000
9.	1.3/20	.09/4 or 9/400
10.	2 87/100	6
11.	.001	3.01
12.	1.5	0.065
13.	3.5	0.15
14.	0.11	0.065
15.	0.00004	0.0025
16.	1.76	0.0060
17.	0.0975	0.00001

18.	1.25	0.85
19.	0.12	0.0020
20.	0.000625	0.0001

Assignment Sheet #4

	a.	b.
1.	16%	35%
2.	66 2/3%	3 1/3%
3.	80%	0.3%
4.	.4 3/4%	0.14%
5.	125%	140%
6.	76%	2%
7.	87 1/2%	50%
8.	0.15%	0.07%
9.	2.76%	13.24%
10.	220%	555%
11.	50%	25%
12.	33 1/3%	16 2/3%
13.	28 4/7%	62.5%
14.	112.5%	100%
15.	93 3/4% or 93.75%	200%
16.	14 2/7%	12.5%
17.	80%	37.5%
18.	66 2/3%	50%
19.	60%	75%
20.	50%	116 2/3%

Assignment Sheet #5

1. $\text{Occupancy rate} = \dfrac{210{,}764}{3{,}071 \times 90} = \dfrac{210{,}764}{276{,}390} = .762 = 76.2\%$

2. Use rate = $\frac{960{,}328}{684{,}520} = 1.403$

3. Average daily census = $\frac{728{,}000 \times 1.4}{365} = \frac{1{,}019{,}200}{365} = 2792.3$

4. Projected bed need = $\frac{2792.3}{.85} = 3{,}285$

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

TEST

1. Match the ten terms on the left with their correct definitions.

_____a. A person who remains in the hospital for treatment, rather than being treated in emergency and sent home

_____b. The twenty-four hour period, usually midnight to midnight, when a count is taken of the number of inpatients

_____c. When a patient is released from the hospital

_____d. Unit of measure meaning one patient staying in a room for one census day

_____e. Percentage of occupancy consisting of the ratio of the ACTUAL number of patient days to the MAXIMUM POSSIBLE number of patient days during a time period

_____f. Ratio of patient days of a given year to the population of that area in that same year

_____g. Average number of inpatients maintained in the hospital each day for a given period of time

_____h. Average number of days of care given to each inpatient discharged during a given period

_____i. All the care given to a patient while he is in the hospital

_____j. Total cost to the hospital of providing one day of care for one patient

1. Use rate
2. Per diem cost
3. Inpatient
4. Census day
5. Patient services
6. Discharge
7. Average length of stay
8. Average daily census
9. Occupancy rate
10. Patient days

2. Identify four jobs from the following list by marking an X by those jobs which primarily use math skills.

   ____________ a. Hospital librarian

   ____________ b. Dietetic technician

   ____________ c. Hospital administrator

   ____________ d. Medical illustrator

   ____________ e. Purchasing agent

   ____________ f. Podiatrist

   ____________ g. Inhalation therapist

   ____________ h. Accountant

   ____________ i. Hospital engineer

   ____________ j. Optometrist

3. Express the following ratios as fractions in the lowest terms.

   a. 3" to 12"

   b. 7' to 28'

   c. 45 qts. to 63 qts.

   d. $5.00 to $.50

   e. 15 hrs. to 45 hrs.

   f. 11 lbs. to 7 lbs.

   g. 50 mi. to 75 mi.

   h. 56 c. to 56 c.

   i. 36" to 48"

   j. 80 hrs. to 90 hrs.

4. Find the value of n in each of the following proportions.

   a. $8/9 = n/54$

   b. $3/7 = n/21$

   c. $15/7 = n/7$

   d. $n/2 = 10/5$

   e. $7/11 = n/22$

5. a. Express the following percents as fractions.

   1) 48%

   2) 26%

   3) 225%

   4) 18%

   5) 0.5%

   b. Express the following percents as decimals.

   1) 11%

   2) 125%

   3) 20%

   4) 0.60%

   5) 301%

6. Express the following decimals and fractions as percents.

   a. 0.17

   b. 0.02

   c. 1.23

   d. 0.027

   e. 2.2

   a. 1/2

   b. 2/3

   c. 1/6

   d. 1/8

   e. 21/28

7. Determine the need for hospital beds in the local community five years from now. (Satisfied by Assignment Sheet #5)

   (NOTE: If this activity has not been accomplished prior to the test, ask your teacher when it should be completed.)

MATHEMATICS IN HEALTH CAREERS
HOSPITAL WORKERS

ANSWERS TO TEST

1.	a.	3	f.	1
	b.	4	g.	8
	c.	6	h.	7
	d.	10	i.	5
	e.	9	j.	2
2.	c, e, h, and i			
3.	a.	1/4"	f.	1 4/7 lbs.
	b.	1/4 ft.	g.	2/3 mi.
	c.	5/7 qt.	h.	1 c.
	d.	10/1¢	i.	3/4"
	e.	1/3 hr.	j.	8/9 hr.
4.	a.	48		
	b.	9		
	c.	15		
	d.	4		
	e.	14		
5.	a.	1) 12/25	b.	1) 0.11
		2) 13/50		2) 1.25
		3) 2 1/4		3) 0.20
		4) 9/50		4) 0.006
		5) .1/20		5) 3.01
6.	a.	17%	a.	50%
	b.	2%	b.	66 2/3%
	c.	123%	c.	16 2/3%
	d.	2.7%	d.	12.5%
	e.	220%	e.	75%
7.	Evaluated to the satisfaction of the instructor.			

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to prepare statistical charts. He should be able to organize, present, interpret, analyze, and make decisions from the given data; match terms and definitions; and identify uses of statistical studies and jobs where statistics are used. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms and definitions associated with statistics and business.
2. List five steps used in compiling a statistical study.
3. Match four jobs with the way each person would use statistics.
4. Name three statistical charts and their uses.
5. Demonstrate the ability to:
    a. Prepare statistical charts.
    b. Organize and present data.
    c. Interpret data.
    d. Analyze data.
    e. Make decisions based on statistics.

This unit was written by Linda Manning in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

SUGGESTED ACTIVITIES

I. Instructor:

    A. Provide students with objective sheet.
    B. Provide students with calculators if possible.
    C. Provide students with information and assignment sheets.
    D. Discuss terminal and specific objectives.
    E. Discuss information and assignment sheets.
    F. Direct students through the different learning paths for each specific objective.
    G. Give test.

II. Student:

    A. Read objective sheet.
    B. Study information sheet.
    C. Complete assignment sheets and turn in to instructor.
    D. Make sure you are able to perform according to the type of performance called for by each specific objective.
    E. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

    A. Objectives
    B. Information sheet
    C. Assignment sheets
        1. Assignment Sheet #1--Prepare Statistical Charts
        2. Assignment Sheet #2--Organize and Present Data

3. Assignment Sheet #3--Interpret Data
4. Assignment Sheet #4--Analyze Data
5. Assignment Sheet #5--Decisions Based on Statistics

D. Answers to assignment sheets

E. Test

F. Answers to test

II. References:

A. McGregor and Chakonas. *Retail Management Problems.* Homewood, Illinois: Richard D. Irwin, Inc., 1970.

B. Brueckner, Grossnickle, Merton. *The New Knowing About Numbers.* Philadelphia: The John C. Winston Co., 1959.

C. Data from Fred Jones Manufacturing Co., Oklahoma City, Oklahoma.

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

INFORMATION SHEET

I. Terms and definitions

   A. Statistics--Branch of mathematics concerned with the collection, organization, presentation, and interpretation of sets of data

   B. Data--Collection of facts

   C. Graph--Pictorial representation of data

   D. Sales--Exchange of property or services of any kind for an agreed sum of money or other valuable considerations

II. Steps in compiling a statistical study

   A. Collect a set of data

   B. Organize data

   C. Present data using tables or graphs

   D. Interpret data

   E. Analyze data

III. Jobs where statistics would be used

   A. Sales manager--Figures increases or decreases in sales to determine months when sales are low, departments selling the most merchandise, and the performance levels of individual salesmen

   B. Merchandising manager--Figures increases or decreases in sales to determine better displays of merchandise and the products in most demand

   C. Accountant--Provides information to sales and merchandise managers for their decisions

   D. Bookkeeper--Posts entries; keeps records for accountant

IV. Statistical charts and their uses

   A. Circle graph--Each segment represents a percentage of the total amount

   B. Bar graph--Differences in amounts are shown by differences in the length of the bars

   C. Line graph--Shows the changes in amount that take place over a period of time

INFORMATION SHEET

V. Steps for drawing statistical charts (Assignment Sheet #1)

A. Circle graph

1. Numbers to be graphed should be expressed as percentages--Find what percent each number is of the total

2. Round off the percent to the nearest whole percent

3. Express each percent as a decimal and multiply by 360°

4. Round off each answer to the nearest degree

   (NOTE: Each product is the number of degrees in a central angle of the graph.)

5. Draw a circle with any convenient radius

6. Draw the central angles found in #4

   (NOTE: A compass and a protractor will be needed to complete steps five and six.)

7. Label the graph

B. Bar and line graph

1. Select a suitable scale for the graph

   (NOTE: Try to have the graph present a true picture by beginning the scale at zero.)

2. Round off each number to be graphed

   (NOTE: There should be no more than three figures other than zero. Thus, 1,723,465 should be rounded off to 1,720,000 or to 1,700,000.)

3. Divide the number to be graphed by the scale value

4. On the horizontal axis, arrange the constants accordingly

   Example: Arrange the items according to a regular time interval.

5. When making a bar graph, make the bars of uniform width and leave a space of uniform width between bars

6. When making a line graph, connect the points with a solid line

7. Label the graph

INFORMATION SHEET

VI. Organizing and presenting data (Assignment Sheet #2)

A. Determining average monthly sales

1. For January, add the sales for each year given
2. Divide by the number of years
3. Perform the same operation described in steps one and two for each month given on the assignment sheet

B. Determining total predicted sales and monthly sales as a percentage of yearly sales

1. Add average monthly sales to determine total predicted sales
2. Divide total predicted sales into the average monthly sales; round off to the nearest ten-thousandth
3. Change the decimal to a percentage

VII. Interpreting data (Assignment Sheet #3)

A. Predicting yearly estimated sales

1. Change the given percentage to a decimal
2. Multiply the yearly predicted sales by the decimal numeral determined in step one
3. Add the figure found in step two and the actual sales of the previous year

B. Predicting monthly goals

1. For January, change the monthly sales expressed as a percent of yearly sales to a decimal
2. Multiply the decimal by the yearly predicted sales
3. Perform the same operations described in steps one and two for each month given

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ASSIGNMENT SHEET #1--PREPARE STATISTICAL CHARTS

1. Prepare a circle graph showing the operating expenses of a store.

Payroll (including taxes and benefits)	$ 159,000
Rent and utilities	37,000
Advertising	8,000
Delivery (except driver wages)	7,000
Licenses and taxes	4,000
Insurance	5,000
Interest	10,000
Depreciation	11,000
All other	20,000

2. Prepare a bar graph showing the men's accessories sales for the year 1972.

January	$ 6,978
February	9,096
March	10,466
April	11,090
May	8,348
June	6,728
July	5,981
August	8,345
September	9,348
October	10,840
November	13,706
December	23,674

3. Prepare a line graph showing the sales of variously priced dresses sold during the months of October, November, and December, 1972.

PRICE	TOTAL SOLD
$ 10.00	11
11.00	73
12.00	16
13.00	11
15.00	79
16.00	99
18.00	127
19.00	66
20.00	53
23.00	40
24.00	28
25.00	87
30.00	34

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ASSIGNMENT SHEET #2--ORGANIZE AND PRESENT DATA

1972 Sales Quota
District: Oklahoma

MONTH	1970 SALES	1971 SALES
January	155,725	174,713
February	170,555	161,606
March	156,544	167,938
April	164,403	184,881
May	174,944	168,694
June	185,633	235,701
July	196,592	265,932
August	219,188	207,786
September	157,324	198,441
October	177,318	221,744
November	193,172	228,209
December	173,848	236,718
Totals	2,125,246	2,452,363

1. Using the sales figures of 1970 and 1971, find the average monthly sales.

    a. January
    b. February
    c. March
    d. April
    e. May
    f. June
    g. July
    h. August
    i. September
    j. October
    k. November
    l. December
    m. Total average sales

2. Express each month's average monthly sales as a percentage of the year's predicted sales.

    a. January
    b. February
    c. March
    d. April
    e. May
    f. June
    g. July
    h. August
    i. September
    j. October
    k. November
    l. December

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ASSIGNMENT SHEET #3--INTERPRET DATA

One of the functions of a sales manager is to determine objectives for the coming year. Use the data compiled in Assignment Sheet #2 to help you.

1. The sales manager has predicted an increase of 10% in sales over the previous year's sales. What are the predicted sales for 1972? ______________________

2. The sales manager must also predict what must be sold each month to meet the year's goal. Determine the 1972 monthly sales objectives.

   a. January
   b. February
   c. March
   d. April
   e. May
   f. June
   g. July
   h. August
   i. September
   j. October
   k. November
   l. December

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ASSIGNMENT SHEET #4--ANALYZE DATA

At the end of the year, the sales manager holds a sales meeting and reviews the year's sales.

12/31/72
District: Oklahoma

MONTH	PREDICTED SALES FOR 1972	ACTUAL SALES FOR 1972
January	194,497	207,700
February	195,576	211,480
March	190,990	239,568
April	205,827	212,937
May	202,320	221,608
June	248,179	250,997
July	272,457	265,182
August	251,416	254,692
September	209,603	213,785
October	234,961	269,157
November	248,179	250,623
December	241,705	261,830
Total		

1. Find
   a. Total predicted sales for 1972 for the district of Oklahoma. ______________
   b. Total actual sales for 1972 for the district of Oklahoma. _________
2. Find, by month, the percentage to the nearest hundredth of actual sales to predicted sales for the district of Oklahoma.
   a. January
   b. February
   c. March
   d. April
   e. May
   f. June
   g. July
   h. August
   i. September
   j. October
   k. November
   l. December
3. To the nearest hundredth, find the percentage of actual sales to predicted sales for the year 1972 for the district of Oklahoma. ____________________

ASSIGNMENT SHEET #4

4. The total national sales for the year 1972 were 18,608,586. To the nearest hundredth, find the percentage of the Oklahoma district sales to the national sales. ____________________

5. The Oklahoma district was to have been responsible for 15.25% of the total national sales. By what percent were they over or under their goal? ____________

6. At the sales meeting, the sales manager decides to use a visual aid to show the year's accomplishments.

   a. Construct a line graph, using a dotted line to show the predicted monthly sales for the year 1972.

   b. On the same graph, use a solid line to show by month the actual sales.

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ASSIGNMENT SHEET #5--DECISIONS BASED ON STATISTICS

Divide into groups of five students. Use the information from Assignment Sheet #4 to look at actual sales for 1972. Determine the following.

1. Which month is the lowest in sales?

2. What are some reasons why this might be the lowest month?

3. Prepare a radio, TV, or newspaper advertisement designed to increase sales for that month.

4. Can you think of other decisions which the merchandising manager or sales manager might make from the information provided on Assignment Sheet #4?

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1 (See graph paper)

Assignment Sheet #2

1. a. 165,219
   b. 166,081
   c. 162,241
   d. 174,642
   e. 171,819
   f. 210,667
   g. 231,262
   h. 213,487
   i. 177,883
   j. 199,531
   k. 210,691
   l. 205,283
   m. 2,288,805
2. a. 7.22%
   b. 7.26%
   c. 7.09%
   d. 7.63%
   e. 7.51%
   f. 9.20%
   g. 10.10%
   h. 9.32%
   i. 7.77%
   j. 8.72%
   k. 9.21%
   l. 8.97%

Assignment Sheet #3

1. 2,697,599
2. a. 194,767
   b. 195,846
   c. 191,260
   d. 205,827
   e. 202,590
   f. 248,179
   g. 272,457
   h. 251,416
   i. 209,603
   j. 235,231
   k. 248,449
   l. 241,975

Assignment Sheet #4

1. a. 2,695,710
   b. 2,859,559
2. a. 106.79%
   b. 108.13%
   c. 125.43%
   d. 103.45%
   e. 109.53%
   f. 101.14%
   g. 97.33%
   h. 101.30%
   i. 102.00%
   j. 114.55%
   k. 100.98%
   l. 108.33%
3. 106.08%
4. 15.37%
5. .12% over
6. (See graph paper)

Assignment Sheet #5

1. January

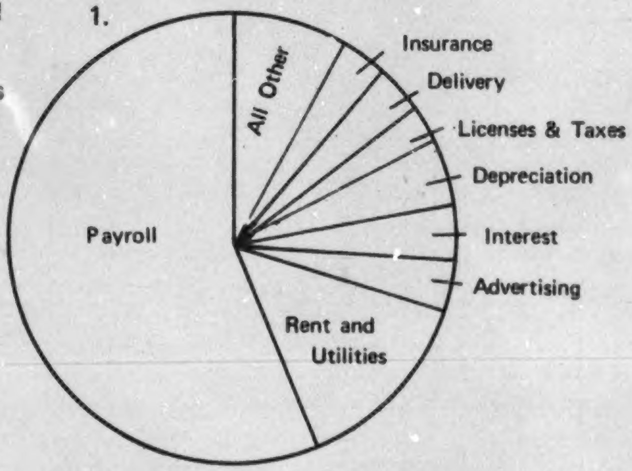
2., 3., 4. Evaluated to the satisfaction of the instructor.

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

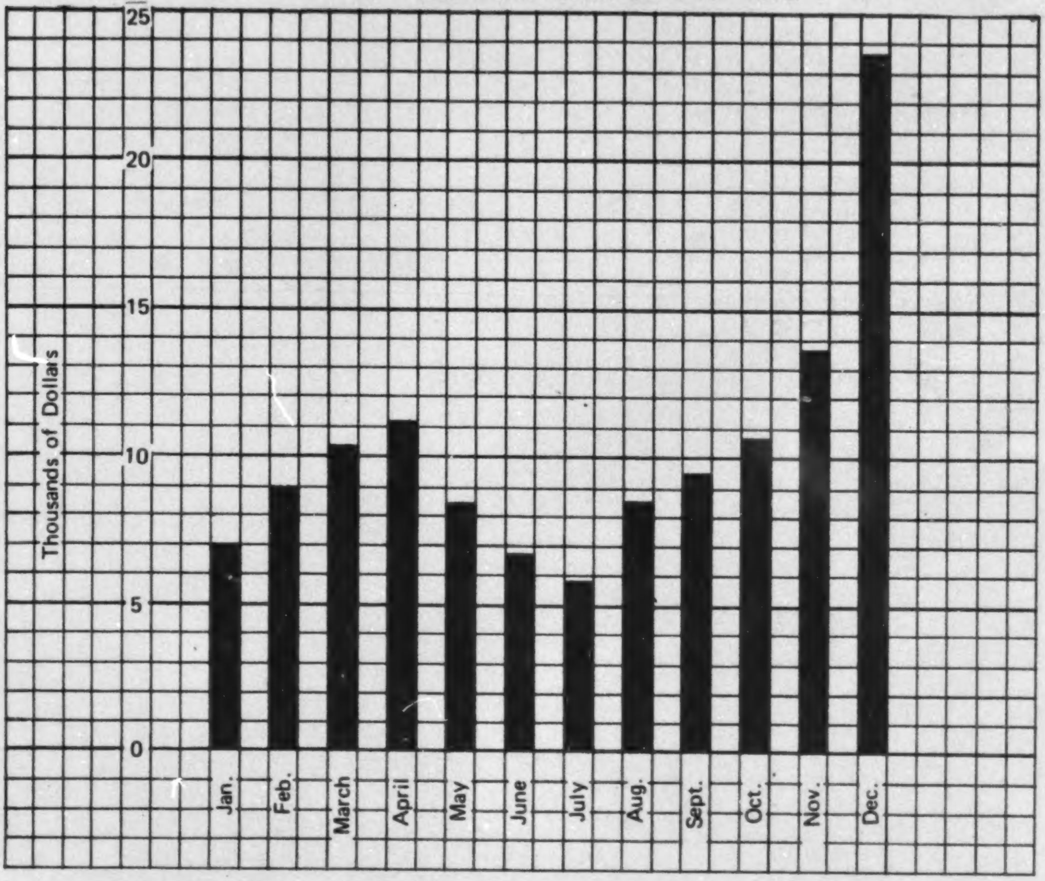
Operating Expenses

1.



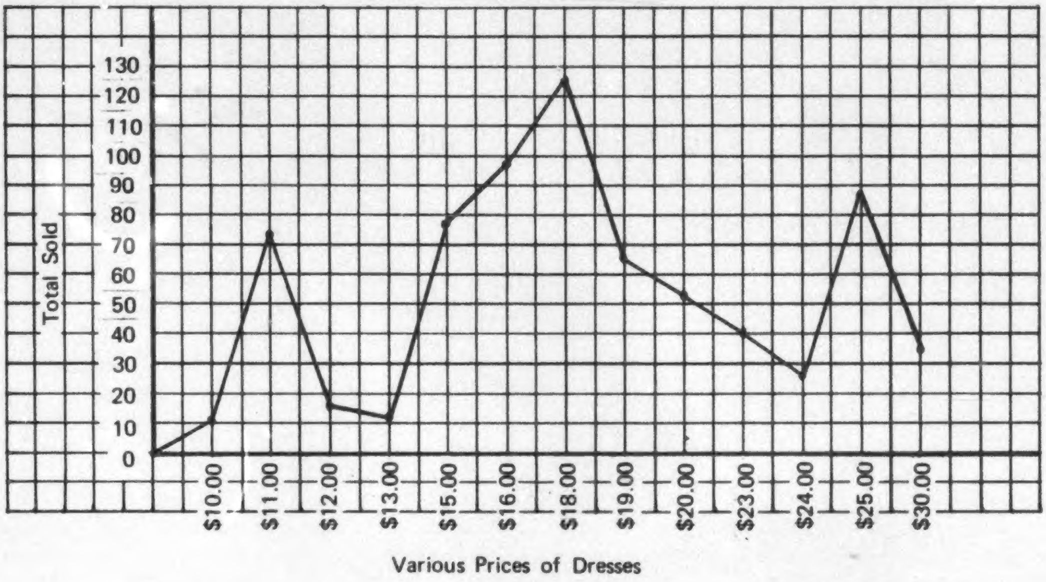
2.

Men's Accessories Sales for 1972

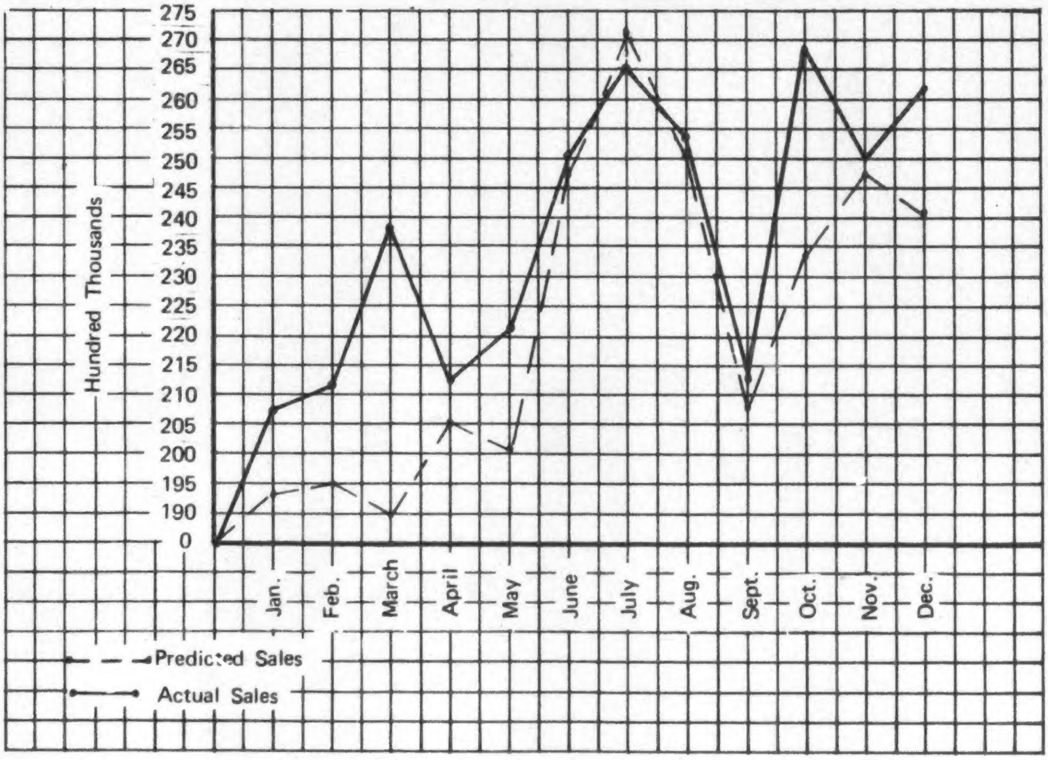


ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1   3.   Dress Sales Oct., Nov., and Dec., 1972



Assignment Sheet #4   6.   Predicted and Actual Sales for 1972



MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

TEST

1. Match the terms on the right to the correct definition.

_____a. Collection of facts

_____b. Exchange of property or services of any kind for an agreed sum of money or other valuable considerations

_____c. Branch of mathematics concerned with the collection, organization, presentation, and interpretation of sets of data

_____d. Pictorial representation of data

1. Statistics
2. Data
3. Graph
4. Sales

2. List five steps used in compiling a statistical study.

a.

b.

c.

d.

e.

3. Match the four jobs on the right to the correct description of how each person uses statistics.

_____a. Posts entries; keeps records for accountant

_____b. Figures increase or decrease in sales to determine better displays of merchandise and the products in most demand

1. Sales manager
2. Merchandising manager
3. Accountant
4. Bookkeeper

______c. Provides information to sales and merchandise managers for their decisions

______d. Figures increases or decreases in sales to determine months when sales are low, departments selling the most merchandise, and the performance levels of individual salesmen

4. Name three statistical charts and their uses.

   a.

   b.

   c.

5. Demonstrate the ability to:

   a. Prepare statistical charts.

   b. Organize and present data.

   c. Interpret data.

   d. Analyze data.

   e. Make decisions based on statistics.

   (NOTE: If these activities have not been completed prior to this test, ask the instructor when they should be completed.)

MATHEMATICS IN BUSINESS AND OFFICE OCCUPATIONS
STATISTICS FOR DECISION MAKING

ANSWERS TO TEST

1. a. 2

   b. 4

   c. 1

   d. 3

2. a. Collect a set of data

   b. Organize data

   c. Present data using tables or graphs

   d. Interpret data

   e. Analyze data

3. a. 4

   b. 2

   c. 3

   d. 1

4. a. Circle graph--Each segment represents a percentage of the total amount

   b. Bar graph--Differences in amounts are shown by differences in the length of the bars

   c. Line graph--Shows the changes in amount that take place over a period of time

5. Performance tasks evaluated to the satisfaction of the instructor.